

# 2007 Washington State University Research Annual Report

Status: Accepted  
Date Accepted: 06/12/08

2007 Washington State University Research Annual Report

## I. Report Overview

### 1. Executive Summary

This was a productive year for the scientists in the Washington State University (WSU) Agricultural Research Center (ARC), the subunit of the College of Agriculture, Human and natural Resource Sciences (CAHNRS) that administers a significant fraction of the scientific research related to agriculture, broadly defined. Once again, ARC faculty and staff as a group have the largest amount of research grant funding at WSU, \$32.6 million, obtained from various federal sources, state sources, crop commissions, industry, etc.. These funds cover work in a myriad of subject areas and the individual projects approach the work from a variety of perspectives. Washington state agriculture is more diverse than that of many other states, partly as the result of the different climate and soil conditions found in the state, partly because of its emphasis on meeting agricultural needs of both domestic and export markets. This report outlines a few of our major successes and documents the adaptation of the ARC and CAHNRS in response to constraints and opportunities. Researchers on the Pullman campus, at WSU's Research and Extension Centers and at field locations throughout Washington state are engaged in over 300 projects aimed at addressing the needs of Washingtonians and the nation. Our goal is to develop and leverage basic science to ensure that our farms and industries can compete in the global economy with quality products, to protect the security of our food and fiber systems, to keep our population healthy and well nourished, our natural resources and environment protected, and to enhance economic opportunity for individuals, businesses and communities. The work is of high quality; WSU was listed among the top 25 schools in the world on the basis of citation impact in agricultural science by Science Watch newsletters and various plant and animal science WSU programs based primarily in CAHNRS were highly ranked in a 2007 survey published in the Chronicle for Higher Education (<http://researchnews.wsu.edu/society/163.html>). Washington State has been a leader in developing practices to support sustainable agriculture, including low erosion cultivation techniques, minimal pesticide and herbicide applications, and breeding for disease and pest resistance. The state has also been innovative in supporting scientific research in organic production techniques and in implementing value added marketing based on organic and limited input production systems. Researchers have moved aggressively into aspects of biofuels, biomass, and bioproducts research of particular relevance to the state. These include projects to add value to straw and other „waste,„ products, to improve the yield and stability of crops like poplars that have been identified as a potential energy crops well suited to this region and produce useful materials from various waste streams associated with food and fiber production. So, for example, the plantation culture of poplar in Washington and Oregon is potentially vulnerable to the Western poplar clearwing moth, the larvae of which can kill young trees and make mature timber unusable. John Brown and Doug Walsh have found that by using pheromones and other IPM strategies they are able to limit these outbreaks with relatively low inputs of insecticides. Jon Johnson is evaluating poplar trees for their potential use in ethanol production, a process that is aided by Norman Lewis, who is an expert in lignin, the component of wood that is most inhibitory to converting poplar to liquid fuels. Mike Wolcott and his colleagues are studying whether waste steams that contain carbohydrates can be used to support the production of bioplastics. How production of non-food products from crops influences and is influenced by input costs and markets is being studied by Jonathan Yoder and other economists. Rapid shifts in the production and consumption boundary conditions can have serious consequences for producers trying to choose what to do in a shifting agricultural economy. These and other projects are featured in <http://www.arc.wsu.edu/researchimpacts/images/ARC%20Bioproducts%20Report2.pdf>. A major emphasis in CAHNRS is the Human Resource development contained in the college name. Moving the Department of Economics from the College of Business and merging this with the Department of Agricultural Economics, has inspired a flush of investment in new faculty positions to support the expanded teaching, research, and outreach activities of the new unit. Programs in Human Development and Rural Sociology focus on aspects of family and community structures that are also keys to sustainable agriculture. The buildings being constructed on the WSU main campus and at field stations contribute to the excitement in research. September, 2007 saw the dedication of the new Orville Vogel Plant Biosciences Building. Funded by the state legislature, the 93,000-square-foot, four-story structure is located next to several older buildings in the CAHNRS precinct of the WSU-Pullman campus. It was named for an important USDA-ARS wheat breeder who developed dwarf wheat and made many other contributions to local and world agriculture. It houses 30 research labs and lab support areas on three secured upper floors. Four major teaching labs with adjacent equipment demonstration and support areas are located on the first floor along with a study lounge. The building is connected to Johnson Hall and was built to complement the older building by incorporating many facilities, like climate-controlled rooms and high tech laboratories, that would have been difficult to install in Johnson. Assignment of space of this facility was made mostly on the basis of need for these new facilities and not by departmental unit. The building is the first in what eventually may become a complex of seven interconnected buildings devoted to the Life Sciences. A second building is now under construction and will house the School of Molecular Biosciences from the College of Sciences. The objective is to bring state and federal scientists with both fundamental and applied research orientations into closer proximity, fostering collaboration in various areas of life sciences research. In addition, a new building was dedicated in late 2006 at the Mt. Vernon Research and Experiment Station, and will focus on supporting various horticultural crops that are grown in the coastal

regions of the State. New orchards, vineyards, and greenhouses are also being build to support research projects that deal with fruit, vegetable, grain crops, forest products, meat and dairy production, and animal health. The reports in the Planned Program areas reflect and overview of some of the activities in 2007. However, the reporting vehicle is not well suited to describing major changes in the Plan of Work for these areas and the Program directors were advised to try to make the configuration of the report reflect the current situation rather than simply to fill in the boxes. Three Programs were especially affected: Animal Sciences, Food Science and Human Nutrition and the IMPACT Center, which coordinates projects that deal with international market development. Animal Sciences hired a new chair this year and the conceptual basis of the reports in this area have been consolidated and are more oriented to area objectives than specific projects. Food Science and Human Nutrition has undergone significant reorganization in preparation for a unique merger of the WSU department with the corresponding unit at the University of Idaho, which is located just across the State border. The WSU nutrition faculty members were transferred to the College of Pharmacy in order to align faculty research interests of the remaining faculty with those at Idaho. This integrated department is now seeking a new chair. Finally, the previous consolidation of the CAHNRS Department of Agricultural Economics with the Department of Economics from the College of Business to give a CAHNRS School of Economic Sciences is assimilating some of the IMPACT activities and this is relected in altered reporting of areas and accomplishments. The IMPACT Center was also one of the units affected in a major way in 2007 by the unusual federal appropriations in the Special Grants and Formula Funds. WSU lost ~\$2.5 million relative to previous years. In order to maintain as much continuity as possible, the ARC protected projects that involved graduate student researchers and those that where a gap in work-flow would have been especially disruptive. But the bridging mechanisms we used are not sustainable and, if something similar happens in the future, many Programs will be severely disrupted.

#### Total Actual Amount of professional FTEs/SYs for this State

Year:2007	Extension		Research	
	1862	1890	1862	1890
<b>Plan</b>	0.0	0.0	497.2	0.0
<b>Actual</b>	0.0	0.0	501.0	0.0

## II. Merit Review Process

### 1. The Merit Review Process that was Employed for this year

- Expert Peer Review
- Other (individual external peer reviewers from within or without the university )

### 2. Brief Explanation

Agricultural Research Center (ARC) project proposals are written by individual faculty members or faculty teams and are submitted first to their department chairs. The department chair reviews the submission and ascertains whether the topic of the research is consistent with departmental and College goals and, if so, sends the project proposal to internal and/or external reviewers. These reviewers are asked whether the research represents solid science, is directed to topics of current interest, will advance the field of study, and whether the research plan is appropriate. Reviewers are invited to offer suggestions for improvement and asked to identify the strongest and weakest points of the proposal. After comments are received from the reviewers, the chair assembles the commentary and submits it to the faculty member. The faculty member then revises the project proposal. After examining these changes, the Chair submits the project proposal to the Agricultural Research Center where it is reviewed by either the Director or the Associate Director. After this review, the proposal is sent to the USDA-CSREES for review by the appropriate National Program Leader. When approval is final, the approved project is entered into our database and into the CRIS system. In parallel, proposals that may overlap these projects are often submitted to federal or state agencies or to commodity commissions. These proposals are reviewed and input, especially from the commissions, is often used in refocusing and in setting future research directions.

## III. Stakeholder Input

### 1. Actions taken to seek stakeholder input that encouraged their participation

- Targeted invitation to traditional stakeholder groups
- Targeted invitation to non-traditional stakeholder groups
- Targeted invitation to traditional stakeholder individuals
- Targeted invitation to non-traditional stakeholder individuals

### Brief Explanation

Stakeholders in the State recognize WSU as a major asset in their industries and are often very forthcoming with suggestions and critiques. We have web pages, our phone numbers are in plain sight and our stakeholders are used to giving both formal and informal input to the leaders of the Planned Programs and to the ARC administration. One major mechanism of interaction is through the State commodity commissions, which support research at WSU through competitive processes that tend to be biased toward projects that address relatively immediate problems. In addition to researchers, the ARC Director or his representative is often present at these sessions to help the groups understand the context of the research and to get their input into the strategic planning done at WSU related to their industry. Stakeholder input is also received by presence on various advisory committees to departments, centers, and programs. There is College level advisory committee as well as a college level agricultural kitchen cabinet both of which interact with the dean, the experiment station director, and other associate deans helping to define priorities, emerging research issues, and provide feedback on the quality and relevance of our research (extension, and teaching) activities.

**2(A). A brief statement of the process that was used by the recipient institution to identify individuals and groups stakeholders and to collect input from them**

**1. Method to identify individuals and groups**

- Use Advisory Committees
- Use Internal Focus Groups
- Use External Focus Groups
- Open Listening Sessions

**Brief Explanation**

Established industries tend to have formal bodies that we have worked with through the years and many of our interactions with these industries are through these constituent groups. The situation is more complex in interacting with emerging groups, particularly if these are not organized with a component that includes research support. Often the contacts with these groups are made through specific issues, like carrying out the research to certify a pesticide for a minor crop, dealing with a land use issue that is peculiar to their industry, or determining methods that can be used locally to establish sustainable production. Much of what is done in these cases is to identify what capabilities we have that can be useful and in trying to develop a plan to obtain or allocate resources. For various reasons, the ARC has relatively little funding or personnel that can be redirected rapidly so, especially for minor crops, it is important to see areas where resources can be shared through coalition building, often with other stakeholders or other universities.

**2(B). A brief statement of the process that was used by the recipient institution to identify individuals and groups who are stakeholders and to collect input from them**

**1. Methods for collecting Stakeholder Input**

- Meeting with traditional Stakeholder groups
- Meeting with traditional Stakeholder individuals
- Meeting specifically with non-traditional groups
- Meeting specifically with non-traditional individuals
- Meeting with invited selected individuals from the general public

**Brief Explanation**

We go to meetings. We listen. Established industries tend to have formal bodies that we have worked with through the years and many of our interactions with these industries are through these constituent groups. The situation is more complex in interacting with emerging groups, particularly if these are not organized with a component that includes research support. Contacts with these groups are often made through specific issues, like carrying out the research to certify a pesticide for a minor crop, dealing with a land use issue that is peculiar to their industry, or determining methods that can be used locally to establish sustainable production. In these cases we try to identify capabilities we have that might be useful and often try to develop a plan to obtain or allocate resources. The ARC has relatively little funding or personnel that can be redirected rapidly so, especially for minor crops, it is important to see areas where resources can be shared through coalition building, often with other stakeholders or other universities. As a State institution, we also have stakeholders referred to us by the legislature or by State and county executives.

**3. A statement of how the input was considered**

- To Identify Emerging Issues
- Redirect Research Programs
- In the Staff Hiring Process
- In the Action Plans
- To Set Priorities

**Brief Explanation**

The input from stakeholders enters our research programs at several levels. Through direct funding decisions and the participation of the ARC administrators or their delegates in the funding process, we see stakeholders state their priorities and allocate their own money to research at WSU and elsewhere. Sometimes a project may be structured to include objectives that are more easily supported within the ARC and those supported by the stakeholders. The ARC takes the prioritization into account in allocating resources, such as space or positions, and communicates our limitations to groups that often are better placed to obtain additional resources. As a State group, we are charged with responding to those who look to us for help, in so far as we can with the resources we have been allocated.

**Brief Explanation of what you learned from your Stakeholders**

The overwhelming message is that stakeholders want more help in research and its applications. Especially because Washington State agriculture is so diverse and has so many minor crops, the research capability at WSU can be a key to bringing new crops to profitability under local conditions. Historically, this has meant breeding more productive wheat varieties, developing methods for controlled atmosphere storage, choosing wine varieties suited to particular sites, and developing procedures for organic and sustainable agriculture. Conflict can arise when this broad need meets the limited resources available.

**IV. Expenditure Summary**

1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)			
Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	5836138	0

2. Totaled Actual dollars from Planned Programs Inputs				
	Extension		Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	0	0	4554609	0
Actual Matching	0	0	17162360	0
Actual All Other	0	0	30824682	0
Total Actual Expended	0	0	52541651	0

3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from previous years				
Carryover	0	0	0	0

## V. Planned Program Table of Content

S. NO.	PROGRAM NAME
1	Program in Food Science and Human Nutrition
2	Program in Animal Science
3	The IMPACT Center
4	Western Regional Plant Introduction Station (W-006)
5	Program in Plant Pathology
6	Program in Economic Sciences
7	Program in Statistics
8	Program in Community and Rural Sociology
9	Program in Agricultural Animal Health
10	Program in Fruit and Vegetable Development, Production and Management
11	Program in the Post Harvest Quality of Fruits and Vegetables
12	Program in Environmental Horticulture
13	Program in Entomology
14	Program in Natural Resource Sciences
15	Wood Materials Engineering Laboratory
16	Program in Biological Systems Engineering
17	Institute of Biological Chemistry
18	Program in Crop Genetics and Breeding
19	Program in Sustainable Crop and Soil Management

**Program #1****V(A). Planned Program (Summary)****1. Name of the Planned Program**

Program in Food Science and Human Nutrition

**V(B). Program Knowledge Area(s)****1. Program Knowledge Areas and Percentage**

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
501	New and Improved Food Processing Technologies			17%	
502	New and Improved Food Products			15%	
503	Quality Maintenance in Storing and Marketing Food Products			11%	
504	Home and Commercial Food Service			3%	
701	Nutrient Composition of Food			2%	
702	Requirements and Function of Nutrients and Other Food Components			23%	
703	Nutrition Education and Behavior			11%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins			18%	
	<b>Total</b>			100%	

**V(C). Planned Program (Inputs)****1. Actual amount of professional FTE/SYs expended this Program**

Year: 2007	Extension		Research	
	1862	1890	1862	1890
<b>Plan</b>	0.0	0.0	41.2	0.0
<b>Actual</b>	0.0	0.0	24.0	0.0

**2. Actual dollars expended in this Program (includes Carryover Funds from previous years)**

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	136970	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	1413156	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	1489337	0

**V(D). Planned Program (Activity)****1. Brief description of the Activity**

We will conduct research and disseminate results to the public, industry and scientists on food safety, quality and technology, (1) expand the existing pilot plant to better serve the needs of the food industry, and (2) deliver educational programs on food handling, HACCP, food sanitation, food safety, food quality, and emerging food processing technologies to the public.

**2. Brief description of the target audience**

Our target audience includes research and extension scientists in the disciplines of food sciences and human nutrition, food engineering, the medical community, persons interested in policy, legislators and the general public. We also have an audience in the Native American and Hispanic communities.

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

**Target for the number of persons (contacts) reached through direct and indirect contact methods**

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
Plan	0	0	0	0
2007	0	0	0	0

**2. Number of Patent Applications Submitted (Standard Research Output)**

**Patent Applications Submitted**

Year	Target
Plan:	3
2007 :	1

**Patents listed**

Dewi Setiady, Barbara Rasco's PhD student on 'Optical scanner for food color measurement.'

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

	Extension	Research	Total
Plan			
2007	0	4	4

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Peer reviewed journal publications

Year	Target	Actual
2007	21	22

**Output #2**

**Output Measure**

- Graduate students supported by experiment station funding and grants

Year	Target	Actual
2007	10	12

**V(G). State Defined Outcomes****V. State Defined Outcomes Table of Content**

<b>O No.</b>	<b>OUTCOME NAME</b>
1	Investigation of rapid detection systems for food contamination
2	Investigation of novel food processing and storage methods
3	Scientists and companies would use the information we have published to further their research and food production practices
4	Rapid detection systems move to a pilot plant testing phase
5	Information in published research is incorporated into production practices thus improving the safety of the food supply.
6	Novel rapid detection methods for food pathogens become available to the food and processing industries improving the safety of the food supply

**Outcome #1****1. Outcome Measures**

Investigation of rapid detection systems for food contamination

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	1	1

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)****What has been done**

Development of a rapid method of detection for food contamination.

**Results**

Using the new methods we can save more than 23 hours in measuring E. coli numbers in foods. We are working to establish a more stable procedure. However, the current method is very promising and helpful for both food safety and quality.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies

**Outcome #2****1. Outcome Measures**

Investigation of novel food processing and storage methods

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	2	2

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Food Industry to improve food quality.

**What has been done**

Effect of microwave radiofrequency, ultrahigh pressure and pulsed electric fields on food safety and quality.

**Results**

Improve functionality of whey proteins as ingredients in foods.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies

**Outcome #3****1. Outcome Measures**

Scientists and companies would use the information we have published to further their research and food production practices

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	10	11

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies

**Outcome #4****1. Outcome Measures**

Rapid detection systems move to a pilot plant testing phase

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	1	1

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

Evaluated a unique enzyme of E.coli for rapid monitoring of the microorganism in Food. Determined specificities of certain enzymes formed by residual chymosin during ripening of semi-hard cheese.

### Results

Continue to work on developing a 10-15 minute rapid method to enumerate E.coli in food. Elucidation of peptidase activities on casein derived bitter peptides may allow specific manipulations of lactic acid bacteria resulting in decreased ripening times and increased cheese quality.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

### Outcome #5

#### 1. Outcome Measures

Information in published research is incorporated into production practices thus improving the safety of the food supply.

#### 2. Associated Institution Types

•1862 Research

#### 3a. Outcome Type:

Change in Knowledge Outcome Measure

#### 3b. Quantitative Outcome

Year	Quantitative Target	Actual
2007	0	1

#### 3c. Qualitative Outcome or Impact Statement

##### Issue (Who cares and Why)

The food industry in Washington and consumers.

##### What has been done

Training in HACCP, safe quality foods and food sanitation. Research on food microbiology is included into these programs.

##### Results

Safer food production which translates to a safe food supply for consumers. Changes in food handling and packaging processes in the industry to prevent foodborne illness.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
501	New and Improved Food Processing Technologies

### Outcome #6

#### 1. Outcome Measures

Novel rapid detection methods for food pathogens become available to the food and processing industries improving the safety of the food supply

#### 2. Associated Institution Types

•1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	1	1

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)****What has been done**

Evaluated a unique enzyme of E.coli for rapid monitoring of the microorganism in food. With conventional methods it took about 24 hours to measure, however we are working to develop a 10-15 minute rapid method to enumerate E.coli in food.

**Results**

Using these new methods, we can save more than 23 hours measuring E.coli numbers in food. This will be very helpful for food safety and quality.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
501	New and Improved Food Processing Technologies

**V(H). Planned Program (External Factors)****External factors which affected outcomes**

- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration,new cultural groupings,etc.)

**Brief Explanation**

In 2007, the Special Grants funds were interrupted. Two Program faculty commented on the consequences in their areas: The loss of Special Grants funds in 2007 has been a disaster for regional collaborative projects in aquaculture as special grants are the only source of funds nationally for this work (with minor amounts of commodity funds for catfish in the south). To set a context, aquaculture and fisheries safety and utilization research came to an end in the US in the late 1980s with the elimination of this research emphasis from the NMFS budget and major cutbacks at the federal labs. Because this area of research and the associated commodities were never a focus of USDA and fisheries science (with exception of biology and genetics) was not part of the mission of NSF (or Commerce, etc.), we would be completely floundering about if not for USDA Special Grants. Our current 10-year collaboration between UC-Davis, the Oregon universities, Idaho and WSU and most recently Montana and Florida, where they raise Siberian sturgeon!! These efforts have resulted in the launching a commercial sturgeon industry in the US. In addition, because of this work, we have a better understanding of life history, physiology, reproduction, of these species and this knowledge has had an impact on threatened and endangered species in the US. One of the most successful Special Grants has been the Northwest Center for Small Fruit Research. A joint regional effort between ARS and three universities (WSU, OSU, and UI), the research performed has helped numerous industries critical to the Pacific Northwest (PNW). In addition, the Center has provided badly needed support for graduate students (MS and PhD), individuals who are then hired by these same industries. Any further loss of funding will be highly destructive to the small fruits industries in the PNW and remove opportunities to train new students.

**V(l). Planned Program (Evaluation Studies and Data Collection)**

**1. Evaluation Studies Planned**

- Other (See below)

**Evaluation Results**

Peer reviewed Publications;

**Key Items of Evaluation**

**Program #2**

**V(A). Planned Program (Summary)**

**1. Name of the Planned Program**

Program in Animal Science

**V(B). Program Knowledge Area(s)**

**1. Program Knowledge Areas and Percentage**

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
112	Watershed Protection and Management			5%	
141	Air Resource Protection and Management			5%	
301	Reproductive Performance of Animals			20%	
302	Nutrient Utilization in Animals			20%	
303	Genetic Improvement of Animals			15%	
304	Animal Genome			10%	
305	Animal Physiological Processes			15%	
308	Improved Animal Products (Before Harvest)			5%	
502	New and Improved Food Products			5%	
	<b>Total</b>			100%	

**V(C). Planned Program (Inputs)**

**1. Actual amount of professional FTE/SYs expended this Program**

Year: 2007	Extension		Research	
	1862	1890	1862	1890
<b>Plan</b>	0.0	0.0	19.0	0.0
<b>Actual</b>	0.0	0.0	27.0	0.0

**2. Actual dollars expended in this Program (includes Carryover Funds from previous years)**

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	499911	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	1478356	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	1044714	0

**V(D). Planned Program (Activity)**

**1. Brief description of the Activity**

The program in the Department of Animal Sciences will include both basic and applied research that addresses issues of current importance and application to the livestock and allied industries and will contribute to various scientific disciplines. Research projects can be grouped into five general categories that fit with Department research priorities and include: Enhanced understanding of nutrient utilization; Enhanced food quality, food safety, consumer acceptance of foods from animal sources and issues of animal and human health; Identification of strategies to decrease the environmental footprint from livestock systems; Enhanced reproductive efficiency of livestock; and Enhanced understanding of mechanisms associate with growth and differentiation of muscle cells and adipocytes. Outputs will include: scientific journal articles; patents; conference publications, proceedings and posters at local, national, and international meetings; workshops; field days; and electronic forms of information transfer.

**2. Brief description of the target audience**

The target audience for this program includes scientists in various disciplines, livestock producers, agribusinesses and consultants, economists, policy makers, government agencies and the general public.

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

**Target for the number of persons (contacts) reached through direct and indirect contact methods**

	<b>Direct Contacts Adults</b>	<b>Indirect Contacts Adults</b>	<b>Direct Contacts Youth</b>	<b>Indirect Contacts Youth</b>
<b>Year</b>	<b>Target</b>	<b>Target</b>	<b>Target</b>	<b>Target</b>
<b>Plan</b>	0	0	0	0
2007	2100	4000	1000	2200

**2. Number of Patent Applications Submitted (Standard Research Output)**

**Patent Applications Submitted**

<b>Year</b>	<b>Target</b>
<b>Plan:</b>	0
2007 :	3

**Patents listed**

1. The UQCRC1 promoter polymorphisms with high expression activity increase muscle lipid accumulation and subcutaneous fat depth.
2. Genetic polymorphisms in the corticotropin releasing hormone gene as markers for improving beef marbling score and subcutaneous fat depth.
3. Urotensin 2 and its receptor as candidate genes for beef marbling score and subcutaneous fat depth.

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

	<b>Extension</b>	<b>Research</b>	<b>Total</b>
<b>Plan</b>			
2007	0	19	19

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Peer reviewed journal articles

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2007	25	19

**Output #2**

**Output Measure**

- Graduate Students supported by Agricultural Research Center and other grant funds

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2007	28	4

## V(G). State Defined Outcomes

## V. State Defined Outcomes Table of Content

O No.	OUTCOME NAME
1	Construct a whole genome association map of nuclear encoded mitochondrial genes for traits in beef cattle
2	Develop mitigation strategies to reduce the impact of animal CAFOs on air and water quality
3	Determine some keys to obesity with research conducted in fat cells
4	Enhanced agricultural sustainability through pollution mitigation strategies
5	Define mineral requirements in dairy cows to reduce mineral excretion
6	Data for CAFOs on air and water quality will be made available to allow policy decisions
7	Sulfur hexachloride tracer technologies developed for measuring methane production by free ranging livestock
8	Better understanding of of the percent of Wagyu genetics required in breed crosses of composite breeds to produce quality beef for domestic and world consumption
9	Identification of factors regulating male fertility and sire potential in cattle and swine
10	Enhance agricultural stability through increases in reproductive efficiency in cattle and swine
11	Techniques developed to accelerate the production of genetically modified animals for value-added products and biotechnology
12	Develop a whole genome association map of genes defining fertility and longevity in dairy cows
13	Enhanced understanding of nutrient utilization and mechanisms of nutrient use by animals.
14	Enhanced food quality, food safety, consumer acceptance of foods from animal sources and issues of animal and human health.
15	Identification of strategies to decrease the environmental footprint from livestock systems
16	Enhanced reproductive efficiency of livestock.
17	Enhanced understanding of mechanisms associated with growth and differentiation of muscle cells and adipocytes.

**Outcome #1****1. Outcome Measures**

Construct a whole genome association map of nuclear encoded mitochondrial genes for traits in beef cattle

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	0	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Change in leadership; Changed to Enhanced understanding of nutrient utilization and mechanisms of nutrient use by animals.

**What has been done****Results****4. Associated Knowledge Areas**

KA Code	Knowledge Area
302	Nutrient Utilization in Animals
301	Reproductive Performance of Animals
303	Genetic Improvement of Animals

**Outcome #2****1. Outcome Measures**

Develop mitigation strategies to reduce the impact of animal CAFOs on air and water quality

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	1	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Due to a change in leadership, please look at the added outcomes.

**What has been done**

**Results****4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
502	New and Improved Food Products
303	Genetic Improvement of Animals
304	Animal Genome

**Outcome #3****1. Outcome Measures**

Determine some keys to obesity with research conducted in fat cells

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Quantitative Target</b>	<b>Actual</b>
2007	0	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Due to a change of leadership please see: Identification of strategies to decrease the environmental footprint from livestock systems

**What has been done****Results****4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
302	Nutrient Utilization in Animals
112	Watershed Protection and Management
141	Air Resource Protection and Management

**Outcome #4****1. Outcome Measures**

Enhanced agricultural sustainability through pollution mitigation strategies

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	1	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Due to a change in Leadership please see Enhanced reproductive efficiency of livestock

**What has been done****Results****4. Associated Knowledge Areas**

KA Code	Knowledge Area
303	Genetic Improvement of Animals
304	Animal Genome
301	Reproductive Performance of Animals

**Outcome #5****1. Outcome Measures**

Define mineral requirements in dairy cows to reduce mineral excretion

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	0	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Due to change in leadership please see Enhanced understanding of mechanisms associated with growth and differentiation of muscle cells and adipocytes.

**What has been done****Results****4. Associated Knowledge Areas**

KA Code	Knowledge Area
302	Nutrient Utilization in Animals

**Outcome #6**

**1. Outcome Measures**

Data for CAFOs on air and water quality will be made available to allow policy decisions

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	0	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Due to a change in Leadership the venue has changed. Please see the added outcomes.

**What has been done****Results****4. Associated Knowledge Areas**

KA Code	Knowledge Area
141	Air Resource Protection and Management
112	Watershed Protection and Management

**Outcome #7****1. Outcome Measures**

Sulfur hexachloride tracer technologies developed for measuring methane production by free ranging livestock

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	1	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Due to change in leadership please see added outcomes.

**What has been done****Results**

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
305	Animal Physiological Processes

**Outcome #8****1. Outcome Measures**

Better understanding of of the percent of Wagyu genetics required in breed crosses of composite breeds to produce quality beef for domestic and world consumption

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	0	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Due to change in Leadership please see added outcomes.

**What has been done****Results****4. Associated Knowledge Areas**

KA Code	Knowledge Area
304	Animal Genome

**Outcome #9****1. Outcome Measures**

Identification of factors regulating male fertility and sire potential in cattle and swine

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	0	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Due to change in Leadership please see added outcomes.

**What has been done****Results****4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
301	Reproductive Performance of Animals

**Outcome #10****1. Outcome Measures**

Enhance agricultural stability through increases in reproductive efficiency in cattle and swine

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Quantitative Target</b>	<b>Actual</b>
2007	0	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Due to a change in Leadership please see added outcomes.

**What has been done****Results****4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
141	Air Resource Protection and Management

**Outcome #11****1. Outcome Measures**

Techniques developed to accelerate the production of genetically modified animals for value-added products and biotechnology

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	0	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Due to change in Leadership please see added outcomes.

**What has been done****Results****4. Associated Knowledge Areas**

KA Code	Knowledge Area
303	Genetic Improvement of Animals
301	Reproductive Performance of Animals

**Outcome #12****1. Outcome Measures**

Develop a whole genome association map of genes defining fertility and longevity in dairy cows

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	0	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Due to a change in Leadership please see added outcomes.

**What has been done****Results****4. Associated Knowledge Areas**

KA Code	Knowledge Area
304	Animal Genome

**Outcome #13**

**1. Outcome Measures**

Enhanced understanding of nutrient utilization and mechanisms of nutrient use by animals.

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	{No Data Entered}	5

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Identifying ways to increase the efficiency of nutrient utilization will enhance the sustainability of livestock operations from financial and environmental perspectives. Projects are contributing new information to understanding genetic links associated with nutrient use in animals is valued by the animal production and allied industries. Work in this area is also currently supported by 2 external competitive grants.

**What has been done**

Projects are implementing techniques to study metabolic activity and regulation at the subcellular level. As an example, gene expression techniques are being used to study lipolysis and lipogenesis in lactating cows and mitochondrial energy expenditures in beef cattle at various stages of production.

**Results**

2 refereed journal articles, 3 presentations at international conferences.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
302	Nutrient Utilization in Animals
301	Reproductive Performance of Animals
303	Genetic Improvement of Animals

**Outcome #14****1. Outcome Measures**

Enhanced food quality, food safety, consumer acceptance of foods from animal sources and issues of animal and human health.

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	{No Data Entered}	11

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Projects are of immediate importance to consumers and producers as they impact food safety, food quality, and animal and human health issues. Results are used and valued by commercial beef industry in prevention of beef measles, by leaders in livestock production using genomic technologies for breeding and selection decisions, and by consumers making informed decisions about the quality and safety of the meat they consume. External support for this work further identifies its relevance to industry.

#### What has been done

Methodology to quantify fatty acids associated with meat quality has been developed and is currently evaluated for commercial applications. Identification of genetic markers that are associated with meat quality traits and animal health are being investigated. Management strategies to reduce the incidence of a costly feedlot parasite are being defined.

#### Results

10 refereed publications, 1 patent application

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
502	New and Improved Food Products
304	Animal Genome
303	Genetic Improvement of Animals

### Outcome #15

#### 1. Outcome Measures

Identification of strategies to decrease the environmental footprint from livestock systems

#### 2. Associated Institution Types

•1862 Research

#### 3a. Outcome Type:

Change in Knowledge Outcome Measure

#### 3b. Quantitative Outcome

Year	Quantitative Target	Actual
2007	{No Data Entered}	3

#### 3c. Qualitative Outcome or Impact Statement

##### Issue (Who cares and Why)

The ability to quantify and monitor inputs and outputs of livestock systems is essential for sustainable production. The impact of livestock systems on water and air quality are being addressed in several projects having direct impact on the production systems as well as social impact to the community. Projects are also supported with competitive external federal funds.

##### What has been done

Novel techniques to measure emissions from livestock units have been developed and results are being used in establishing federal and international regulatory guidelines. Precision feeding strategies have been designed to meet animal nutrient requirements while minimizing excretion of minerals. Education tools available to mass audiences nationally, are being developed to aid producers in whole farm nutrient balance practices.

##### Results

3 refereed publications, input to state and national policies.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
141	Air Resource Protection and Management
302	Nutrient Utilization in Animals

### Outcome #16

**1. Outcome Measures**

Enhanced reproductive efficiency of livestock.

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	{No Data Entered}	2

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Reproductive performance and efficiency has many impacts on sustainable livestock production. Projects are designed to identify factors stimulating and mechanisms associated with both male and female germ cell differentiation. Impacts of this work may influence the breeding practices and reproductive performance in livestock operations producing meat and milk. Other work is designed to identify ways to manage reproduction, which has immediate impact to the cattle feedlot industry as well as domestic animals, pets and wild species. This work is also funded by external grants and industry support.

**What has been done**

Bovine testis xenografts have been successfully used to identify factors stimulating germ cell differentiation. In vitro culture requirements for porcine and bovine uterine and testicular fibroblasts were identified and will provide necessary information for future work. A vaccine has been developed that effectively controls the reproductive hormone cycle and thus prevents pregnancy.

**Results**

2 refereed publications.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
304	Animal Genome
303	Genetic Improvement of Animals
301	Reproductive Performance of Animals

**Outcome #17****1. Outcome Measures**

Enhanced understanding of mechanisms associated with growth and differentiation of muscle cells and adipocytes.

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	{No Data Entered}	4

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Endocrine control and cellular mechanisms regulating growth of muscle and adipose cells provide important new information relevant to animals and humans. One project is designed to study the role of myostatin in regulating muscle growth in rainbow trout. Another project studies the regulation and differentiation of adipocytes in the study of fat accretion in domestic species. Projects in this area have potential to make important contributions to human growth and development as well. Work in this project area is also supported with external competitive grants and industry support.

#### **What has been done**

Mechanisms of action and regulation have been identified leading to more complete understanding of muscle growth and development and adipogenesis

#### **Results**

4 peer reviewed publications

#### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
302	Nutrient Utilization in Animals

#### **V(H). Planned Program (External Factors)**

##### **External factors which affected outcomes**

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges

##### **Brief Explanation**

#### **V(I). Planned Program (Evaluation Studies and Data Collection)**

##### **1. Evaluation Studies Planned**

- Before-After (before and after program)
- During (during program)

##### **Evaluation Results**

##### **Key Items of Evaluation**

**Program #3**

**V(A). Planned Program (Summary)**

**1. Name of the Planned Program**

The IMPACT Center

**V(B). Program Knowledge Area(s)**

**1. Program Knowledge Areas and Percentage**

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
501	New and Improved Food Processing Technologies			10%	
502	New and Improved Food Products			10%	
603	Market Economics			10%	
604	Marketing and Distribution Practices			10%	
606	International Trade and Development			15%	
607	Consumer Economics			10%	
609	Economic Theory and Methods			5%	
610	Domestic Policy Analysis			10%	
611	Foreign Policy and Programs			10%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins			10%	
<b>Total</b>				100%	

**V(C). Planned Program (Inputs)**

**1. Actual amount of professional FTE/SYs expended this Program**

Year: 2007	Extension		Research	
	1862	1890	1862	1890
<b>Plan</b>	0.0	0.0	15.3	0.0
<b>Actual</b>	0.0	0.0	8.0	0.0

**2. Actual dollars expended in this Program (includes Carryover Funds from previous years)**

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	0	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	279175	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	765500	0

**V(D). Planned Program (Activity)**

**1. Brief description of the Activity**

The IMPACT Center: (1) uses focused analyses of economic and market intelligence to enhance the competitiveness of Washington's agricultural products in the international marketplace; (2) addresses export-oriented economic and social issues in a timely and relevant fashion; (3) provides exporters and policymakers with timely assessments of the effects and implications of changes in the world marketplace; and (4) generates scholarly publications and pursues external grant funding to support the research, outreach, and engagement mission of the Center.

**2. Brief description of the target audience**

The target audience includes economists, farmers, exporters, policy makers, legislators and scientists in the fields supported by the IMPACT Center funds.

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

**Target for the number of persons (contacts) reached through direct and indirect contact methods**

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
Plan	0	0	0	0
2007	100	1500	0	0

**2. Number of Patent Applications Submitted (Standard Research Output)**

**Patent Applications Submitted**

Year	Target
Plan:	0
2007 :	0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

	Extension	Research	Total
Plan			
2007	0	60	60

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Peer reviewed journal articles

Year	Target	Actual
2007	40	60

**Output #2**

**Output Measure**

- Graduate students supported by experiment station and grant funding

Year	Target	Actual
2007	0	26

**V(G). State Defined Outcomes****V. State Defined Outcomes Table of Content**

<b>O No.</b>	<b>OUTCOME NAME</b>
1	Fundamental Knowledge
2	Grants
3	Scientific Publications
4	Improved/new research methods
5	Expanded knowledge base
6	Graduate students and post-docs trained
7	Research Support increased
8	Developmental Research Advanced
9	New personnel in research positions
10	Increased research capability and capacity
11	Improved research Quality

**Outcome #1****1. Outcome Measures**

Fundamental Knowledge

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	0	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)****What has been done****Results**

Due to a change in leadership this outcome has been deleted.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
609	Economic Theory and Methods

**Outcome #2****1. Outcome Measures**

Grants

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	0	2000000

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Stakeholders seek focused economic analysis of the international market potential for PNW agricultural goods as well as research on new products, food safety, phytosanitary and other trade-related issues. Decreasing state and federal support have made it vital to obtain additional extramural funding to maintain research capacity.

**What has been done**

IMPACT scientists and faculty have secured an additional \$2 million in grants to supplement core funding.

**Results**

Additional research has been funded to supplement core funding from state and federal sources.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
609	Economic Theory and Methods
610	Domestic Policy Analysis
603	Market Economics
502	New and Improved Food Products
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
501	New and Improved Food Processing Technologies
606	International Trade and Development
611	Foreign Policy and Programs
607	Consumer Economics
604	Marketing and Distribution Practices

**Outcome #3****1. Outcome Measures**

Scientific Publications

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Quantitative Target</b>	<b>Actual</b>
2007	0	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)****What has been done****Results**

Due to a change in leadership this outcome has been deleted

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
606	International Trade and Development

**Outcome #4****1. Outcome Measures**

Improved/new research methods

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	0	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)****What has been done****Results**

Due to a change in leadership this outcome has been deleted.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
606	International Trade and Development

**Outcome #5****1. Outcome Measures**

Expanded knowledge base

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	0	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

The IMPACT Center's mandate to improve Washington's agricultural exports includes providing information to stakeholders on market barriers, new products, potential customers, phytosanitary and other trade issues.

**What has been done**

Cutting edge research in the fields of food safety and security, market economics, foreign and domestic policy analysis, international trade and economic theory has been shared with stakeholders through popular media, and peer-reviewed journal articles.

**Results**

Results include a cost-effective fiberboard product from wheat straw; new preservation technology for Washington's fruits and berries; a mechanical harvester for Washington sweet cherries; cost-effective production of Omega-3 fatty acids from cull potatoes; development of a new class of Hard White Wheat to produce bread and noodles for the Asian market; new tests for measuring safety of food products and for E. coli contamination; and high-pressure thermally sterilized vegetables and others.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
609	Economic Theory and Methods

712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
611	Foreign Policy and Programs
610	Domestic Policy Analysis
606	International Trade and Development
501	New and Improved Food Processing Technologies
604	Marketing and Distribution Practices
607	Consumer Economics
502	New and Improved Food Products
603	Market Economics

**Outcome #6****1. Outcome Measures**

Graduate students and post-docs trained

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	0	26

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Washington State University is a land-grant university with a principal mission of educating students. A requirement of each IMPACT project has been the support of a PhD student.

**What has been done**

Twenty-six PhD students have been supported in full or in part by IMPACT Center funding during the past year. Funding is not permitted for post-docs, but many of the individual projects have post-docs supported from alternative funding sources working on the project. IMPACT has one post-doc supported by administrative funding.

**Results**

PhD level students and post docs are working on all IMPACT-funded projects.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
603	Market Economics
607	Consumer Economics
611	Foreign Policy and Programs
610	Domestic Policy Analysis
502	New and Improved Food Products
501	New and Improved Food Processing Technologies
609	Economic Theory and Methods
606	International Trade and Development
604	Marketing and Distribution Practices
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

**Outcome #7****1. Outcome Measures**

Research Support increased

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	0	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Decreasing availability of state and special grant federal funding has made the search for extramural funding increasingly important. The IMPACT Center is increasing its search for cooperative funding from stakeholder sources and from other external agencies.

**What has been done**

IMPACT Center scientists have applied for a variety of commodity commission, federal and industry grants.

**Results**

Scientists were able to obtain \$2 million in external funding relating to IMPACT-funded research projects in 2007.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
606	International Trade and Development
607	Consumer Economics
609	Economic Theory and Methods
502	New and Improved Food Products
610	Domestic Policy Analysis
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
604	Marketing and Distribution Practices
603	Market Economics
611	Foreign Policy and Programs

**Outcome #8****1. Outcome Measures**

Developmental Research Advanced

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	0	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)****What has been done****Results**

Due to a change in leadership this outcome has been deleted.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
606	International Trade and Development

**Outcome #9****1. Outcome Measures**

New personnel in research positions

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Quantitative Target</b>	<b>Actual</b>
2007	0	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Decreased funding has hindered IMPACT's ability to hire new research personnel.

**What has been done**

With reprioritization of existing funds, a new assistant research professor and a new associate for research were hired to conduct IMPACT Center research, outreach, and engagement activities.

**Results**

Research projects focusing on targeted economic research are being planned and conducted by IMPACT Center staff personnel.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
611	Foreign Policy and Programs
501	New and Improved Food Processing Technologies
502	New and Improved Food Products
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
606	International Trade and Development
607	Consumer Economics
609	Economic Theory and Methods
610	Domestic Policy Analysis
603	Market Economics
604	Marketing and Distribution Practices

**Outcome #10****1. Outcome Measures**

Increased research capability and capacity

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	0	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)****What has been done****Results**

Due to a change in leadership this outcome has been deleted.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
606	International Trade and Development

**Outcome #11****1. Outcome Measures**

Improved research Quality

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	0	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)****What has been done****Results**

Due to a change in leadership this outcome has been deleted.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
606	International Trade and Development

**V(H). Planned Program (External Factors)****External factors which affected outcomes**

- 
- Natural Disasters (drought,weather extremes,etc.)
  - Economy
  - Appropriations changes
  - Public Policy changes
  - Government Regulations
  - Competing Public priorities
  - Competing Programmatic Challenges
  - Populations changes (immigration,new cultural groupings,etc.)

**Brief Explanation**

All of the factors listed above contribute to both demands and stress on the research program. The downturn in the state,s economy lessens the support by the legislature to the university. Increased demand by schools, social services, infrastructure repairs and improvements compete with requests for research dollars. Societal changes influence priorities that result in lower support for research in agriculture. The absence of the Special Federal Grant funds in 2007 created special problems for the IMPACT Program. Through the use of reserves and bridging support from ARC, IMPACT survived without cutting student support but these fixes were seen as temporary, one-time solutions. The base funding of IMPACT is from non-federal sources and is committed to maintaining the core level of staffing in the IMPACT Center, consisting of the administrative support, the Director, and a subset of the center staff economists. All additional support necessary for pursuing research initiatives, including research assistants, good and services, travel, computer support, survey materials, report generation, publication costs and the like are provided by the federal funds. Without this support, the effective budget of the IMPACT Center would literally be cut in half and the IMPACT center can not operate. In an attempt to protect the IMPACT functions, some restructuring of the program is taking place, but this is not seen as optimal by any of our stakeholder groups or by the CAHNRS administration.

**V(I). Planned Program (Evaluation Studies and Data Collection)****1. Evaluation Studies Planned**

- During (during program)

**Evaluation Results**

A five year review of the IMPACT Center performance and accomplishments will be conducted by the Faculty Senate of Washington State University during the coming fall semester.

**Key Items of Evaluation**

**Program #4**

**V(A). Planned Program (Summary)**

**1. Name of the Planned Program**

Western Regional Plant Introduction Station (W-006)

**V(B). Program Knowledge Area(s)**

**1. Program Knowledge Areas and Percentage**

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
201	Plant Genome, Genetics, and Genetic Mechanisms			15%	
202	Plant Genetic Resources			50%	
206	Basic Plant Biology			10%	
211	Insects, Mites, and Other Arthropods Affecting Plants			10%	
212	Pathogens and Nematodes Affecting Plants			10%	
215	Biological Control of Pests Affecting Plants			5%	
<b>Total</b>				100%	

**V(C). Planned Program (Inputs)**

**1. Actual amount of professional FTE/SYs expended this Program**

Year: 2007	Extension		Research	
	1862	1890	1862	1890
<b>Plan</b>	0.0	0.0	5.9	0.0
<b>Actual</b>	0.0	0.0	0.0	0.0

**2. Actual dollars expended in this Program (includes Carryover Funds from previous years)**

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	0	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	0

**V(D). Planned Program (Activity)**

**1. Brief description of the Activity**

We shall acquire and conserve specific germplasm, and manage associated information. The outcome is the continued provision of quality germplasm of the species maintained by W-006 and deliver it to researchers. From the utilization of this germplasm both basic and applied research will result. This includes new cultivars, production of genetic maps, analyses of diversity, new medicinal plants and ornamentals. We shall characterize germplasm, using morphological and molecular markers to enhance conservation management, increase utilization of collections, and incorporate the genetic data into public databases. We shall reduce genetic drift in heterogenous accessions, through sampling procedures that maximize effective population. This information will be applied to regeneration programs to provide cost effective methodology to maximize effective population size during regeneration of species and accessions. We shall genotype germplasm collections for diversity analysis and duplication. Results will provide the basic information needed to characterize germplasm collections. It will be useful to scientists interested in the interaction between marker systems and DNA sampling. Characterization data will be made available to the public on GRIN. We shall characterize and enhance Kentucky bluegrass germplasm for seed production in alternative residue management systems. An enhanced understanding of turf quality and yield will provide an understanding if yield can be improved without detrimental effects to turf quality. This should assist the plant breeding community in cultivar development. We shall apply co-dominant markers, cross-taxa and species markers, and the development of parallel methods to elucidate allelic diversity across legume germplasm. This research will result in the identification of unique germplasm in each food legume taxa readily available for basic research and applied plant breeding programs. We shall conduct research on selected germplasm collections for response to close organismal associates such as microorganisms, pathogens, saprophytes, and significant insect pests and disease vectors. Completion of entomology research will identify sources of insect-resistant germplasm for use by breeding programs. We shall detect, identify and control microorganisms which are agents of plant disease or which induce disease in humans or animals consuming such plants. The exploitation of microbial symbionts or saprophytes for enhancement of desirable germplasm properties or resistance to pests & diseases. The use of targeted microbial and plant germplasm for breeding of pest-resistant crops. We shall transfer technology in the form of plant germplasm propagules (seed/clones), research publications and other associated information to scientists. Quality germplasm is distributed, to plant researchers. Plant Introduction material is and will continue to be utilized in the development of superior cultivars. Enhanced productivity, nutritional value and alternate use of plant material will result.

**2. Brief description of the target audience**

The target audience for this program is plant researchers.

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

**Target for the number of persons (contacts) reached through direct and indirect contact methods**

	<b>Direct Contacts Adults</b>	<b>Indirect Contacts Adults</b>	<b>Direct Contacts Youth</b>	<b>Indirect Contacts Youth</b>
<b>Year</b>	<b>Target</b>	<b>Target</b>	<b>Target</b>	<b>Target</b>
<b>Plan</b>	0	0	0	0
2007	0	0	21	0

**2. Number of Patent Applications Submitted (Standard Research Output)**

**Patent Applications Submitted**

<b>Year</b>	<b>Target</b>
<b>Plan:</b>	0
2007 :	0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

	<b>Extension</b>	<b>Research</b>	<b>Total</b>
<b>Plan</b>			
2007	0	10	10

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Peer reviewed journal articles

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2007	10	10

**Output #2**

**Output Measure**

- Graduate students supported on Agricultural Research Center or other grant funds

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2007	1	1

**V(G). State Defined Outcomes****V. State Defined Outcomes Table of Content**

<b>O No.</b>	<b>OUTCOME NAME</b>
1	Completion and publication of our work in peer reviewed journals
2	Continued distribution of valuable germplasm and information
3	Development of valuable germplasm
4	Continued distribution of valuable germplasm
5	Development of new collaborative projects with state federal and international research scientists
6	Continued provision of quality germplasm of the species maintained at the Pullman site and delivered to researchers worldwide
7	Basic and applied research resulting from the sharing of germplasm--production of genetic maps, analyses of diversity, new medicinal plants, ornamentals,etc.
8	Restoration and re-patriotization of germplasm to seed banks in countries of origin. [This is difficult to predict.]

**Outcome #1****1. Outcome Measures**

Completion and publication of our work in peer reviewed journals

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	10	10

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Peer-reviewed publications are valuable resources to the scientific community.

**What has been done**

Ten peer-reviewed publications from this research effort appeared in print in 2007.

**Results**

The results of these studies are available to scientists, worldwide.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
202	Plant Genetic Resources
212	Pathogens and Nematodes Affecting Plants
215	Biological Control of Pests Affecting Plants
211	Insects, Mites, and Other Arthropods Affecting Plants
206	Basic Plant Biology
201	Plant Genome, Genetics, and Genetic Mechanisms

**Outcome #2****1. Outcome Measures**

Continued distribution of valuable germplasm and information

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	18000	22041

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Plant germplasm forms valuable research and development materials for scientists around the world.

**What has been done**

In 2007, the W6 project maintained 77,190 plant accessions comprising 3253 species in 711 genera; 22041 seed packets were distributed worldwide to 740 requests.

**Results**

Essential plant materials were provided to hundreds of research programs worldwide.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
201	Plant Genome, Genetics, and Genetic Mechanisms
215	Biological Control of Pests Affecting Plants
211	Insects, Mites, and Other Arthropods Affecting Plants
202	Plant Genetic Resources
212	Pathogens and Nematodes Affecting Plants
206	Basic Plant Biology

**Outcome #3****1. Outcome Measures**

Development of valuable germplasm

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Quantitative Target</b>	<b>Actual</b>
2007	1	4

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Winter-hardy safflower is needed for improvement of crop survival and productivity.

**What has been done**

The W6 Safflower collection was screened for winterhardiness and promising lines interbred

**Results**

Four germplasm lines with improved winterhardiness were identified and publicly released

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
202	Plant Genetic Resources
206	Basic Plant Biology

**Outcome #4****1. Outcome Measures**

Continued distribution of valuable germplasm

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	18000	22041

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Plant germplasm forms valuable research and development materials for scientists around the world.

**What has been done**

In 2007, the W6 project maintained 77,190 plant accessions comprising 3253 species in 711 genera; 22041 seed packets were distributed worldwide to 740 requests.

**Results**

Essential plant materials were provided to hundreds of research programs worldwide

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
215	Biological Control of Pests Affecting Plants
212	Pathogens and Nematodes Affecting Plants
201	Plant Genome, Genetics, and Genetic Mechanisms
206	Basic Plant Biology
211	Insects, Mites, and Other Arthropods Affecting Plants
202	Plant Genetic Resources

**Outcome #5****1. Outcome Measures**

Development of new collaborative projects with state federal and international research scientists

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	2	2

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Conservation of plant species and populations is a growing concern worldwide.

**What has been done**

Cooperative agreements with scientists in the former Soviet Union and in Guyana were established

**Results**

Ongoing work will result in molecular characterization of native plant populations and in an atlas of native plant species.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
---------	----------------

206	Basic Plant Biology
202	Plant Genetic Resources
201	Plant Genome, Genetics, and Genetic Mechanisms

**Outcome #6****1. Outcome Measures**

Continued provision of quality germplasm of the species maintained at the Pullman site and delivered to researchers worldwide

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	18000	22041

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Plant germplasm forms valuable research and development materials for scientists around the world.

**What has been done**

In 2007, the W6 project maintained 77,190 plant accessions comprising 3253 species in 711 genera; 22041 seed packets were distributed worldwide to 740 requests

**Results**

Essential plant materials were provided to hundreds of research programs worldwide

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
211	Insects, Mites, and Other Arthropods Affecting Plants
215	Biological Control of Pests Affecting Plants
202	Plant Genetic Resources
206	Basic Plant Biology
212	Pathogens and Nematodes Affecting Plants

**Outcome #7****1. Outcome Measures**

Basic and applied research resulting from the sharing of germplasm-  
-production of genetic maps, analyses of diversity, new medicinal plants,  
ornamentals, etc.

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	12	10

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Genetic resources available in the W6 plant collection are vast and need to be characterized in order to make use of these materials.

**What has been done**

Ten publications were produced in 2007 as a result of work on germplasm in the W6 collection.

**Results**

Valuable information has been gained and shared with the scientific community.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
201	Plant Genome, Genetics, and Genetic Mechanisms
202	Plant Genetic Resources
206	Basic Plant Biology

**Outcome #8****1. Outcome Measures**

Restoration and re-patriation of germplasm to seed banks in countries of origin. [This is difficult to predict.]

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Quantitative Target</b>	<b>Actual</b>
2007	0	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
202	Plant Genetic Resources
206	Basic Plant Biology
201	Plant Genome, Genetics, and Genetic Mechanisms

**V(H). Planned Program (External Factors)****External factors which affected outcomes**

- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities

**Brief Explanation**

**V(l). Planned Program (Evaluation Studies and Data Collection)**

**1. Evaluation Studies Planned**

- Before-After (before and after program)
- During (during program)

**Evaluation Results**

**Key Items of Evaluation**

**Program #5**

**V(A). Planned Program (Summary)**

**1. Name of the Planned Program**

Program in Plant Pathology

**V(B). Program Knowledge Area(s)**

**1. Program Knowledge Areas and Percentage**

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
201	Plant Genome, Genetics, and Genetic Mechanisms			3%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants			1%	
206	Basic Plant Biology			1%	
212	Pathogens and Nematodes Affecting Plants			90%	
216	Integrated Pest Management Systems			5%	
	<b>Total</b>			100%	

**V(C). Planned Program (Inputs)**

**1. Actual amount of professional FTE/SYs expended this Program**

Year: 2007	Extension		Research	
	1862	1890	1862	1890
<b>Plan</b>	0.0	0.0	50.7	0.0
<b>Actual</b>	0.0	0.0	70.0	0.0

**2. Actual dollars expended in this Program (includes Carryover Funds from previous years)**

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	653493	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	1985413	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	3513476	0

**V(D). Planned Program (Activity)**

**1. Brief description of the Activity**

Grant proposals will be written. Experiments will be designed. Applied and basic research will be conducted in laboratories, greenhouses, and in field plots. Results of these studies will be summarized, and analyzed statistically. Results of studies will be disseminated to producers in the State, to the lay public, and to other scientists in the discipline and in other disciplines through oral presentations at meetings, field plot tours, extension bulletins, scientific publications, newsletters, and electronically through websites. Peer-reviewed scientific papers, popular press articles, and book chapters will be published. Data will be provided to support registration of crop protection chemicals. Graduate students will be trained to conduct and disseminate research.

**2. Brief description of the target audience**

Targeted audience: Primary producers of and dealers involved with trade of agricultural, forestry, horticultural, seed, and nursery commodities produced in the state; Homeowners and policy makers with need for plant health information; and, other scientists conducting related research. Extension specialists and teachers involved in transmitting information to the public and students.

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

**Target for the number of persons (contacts) reached through direct and indirect contact methods**

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
Plan	0	0	0	0
2007	0	0	0	0

**2. Number of Patent Applications Submitted (Standard Research Output)**

**Patent Applications Submitted**

Year	Target
Plan:	0
2007 :	0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

	Extension	Research	Total
Plan			
2007	70	49	119

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Peer reviewed journal articles

Year	Target	Actual
2007	55	49

**Output #2**

**Output Measure**

- Graduate students supported by experiment station funds

Year	Target	Actual
2007	26	20

**V(G). State Defined Outcomes****V. State Defined Outcomes Table of Content**

<b>O No.</b>	<b>OUTCOME NAME</b>
1	Increased numbers of publications
2	Increased graduate student enrollment
3	Reduced Fungicide Use

**Outcome #1****1. Outcome Measures**

Increased numbers of publications

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	55	49

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Increasing number of peer-reviewed publications reflects greater faculty productivity, which is important to institutional and departmental benchmarks and contributes to national recognition.

**What has been done**

Benchmarks for research productivity were established to emphasize its importance.

**Results**

Overall productivity for peer-reviewed publications in 2007 was similar to 2006.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
216	Integrated Pest Management Systems
206	Basic Plant Biology
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
212	Pathogens and Nematodes Affecting Plants
201	Plant Genome, Genetics, and Genetic Mechanisms

**Outcome #2****1. Outcome Measures**

Increased graduate student enrollment

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	26	20

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Increasing the number of graduate students and especially Ph.D. students is an important institutional and departmental benchmark and contributes indirectly to national recognition.

**What has been done**

A benchmark for increased graduate enrollment was established to emphasize its importance.

**Results**

Graduate education declined in 2007 due to unusual circumstances including a reduced number of graduate applications and some underachieving students who were asked to leave the program.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
216	Integrated Pest Management Systems
212	Pathogens and Nematodes Affecting Plants

**Outcome #3****1. Outcome Measures**

Reduced Fungicide Use

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	0	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Reduced fungicide benefits both the public at large by reducing pesticides released in the environment and to growers by reducing the cost of production and, potentially, by reducing the opportunity for development of fungicide-resistant pathogens.

**What has been done****Results**

Application of weather-based models reduced fungicide use in cherries and grapes by 10 to 18%, respectively, in high disease pressure sites without compromising control. In one low disease pressure site, fungicide use was reduced by 85%.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
216	Integrated Pest Management Systems

**V(H). Planned Program (External Factors)****External factors which affected outcomes**

- Appropriations changes
- Public Policy changes
- Competing Public priorities

**Brief Explanation**

Several projects in the Program were interrupted or work was curtailed because of changes in Special Grants funding.

**V(I). Planned Program (Evaluation Studies and Data Collection)****1. Evaluation Studies Planned**

- During (during program)
- Other (After)

## **Evaluation Results**

### **Key Items of Evaluation**

**Program #6**

**V(A). Planned Program (Summary)**

**1. Name of the Planned Program**

Program in Economic Sciences

**V(B). Program Knowledge Area(s)**

**1. Program Knowledge Areas and Percentage**

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
601	Economics of Agricultural Production and Farm Management			5%	
602	Business Management, Finance, and Taxation			10%	
603	Market Economics			20%	
604	Marketing and Distribution Practices			5%	
605	Natural Resource and Environmental Economics			15%	
606	International Trade and Development			5%	
607	Consumer Economics			10%	
609	Economic Theory and Methods			10%	
610	Domestic Policy Analysis			10%	
901	Program and Project Design, and Statistics			10%	
	<b>Total</b>			100%	

**V(C). Planned Program (Inputs)**

**1. Actual amount of professional FTE/SYs expended this Program**

Year: 2007	Extension		Research	
	1862	1890	1862	1890
<b>Plan</b>	0.0	0.0	22.7	0.0
<b>Actual</b>	0.0	0.0	31.0	0.0

**2. Actual dollars expended in this Program (includes Carryover Funds from previous years)**

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	377788	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	1019236	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	1757062	0

**V(D). Planned Program (Activity)**

**1. Brief description of the Activity**

The expected research outputs will occur in a number of forms. High quality refereed journal articles is one prominent form, which will validate the scientific merit of the research performed and will stand as long term contributions to the inventory of knowledge in the respective areas of inquiry. A number of peer-reviewed and other research bulletins, research reports, and both peer-reviewed and invited presentations disseminating the results of research are expected to be delivered to appropriate clientele by faculty analysts themselves. In addition to outreach efforts by research faculty, which is an expectation of all faculty in the School of Economic Sciences, research results will be translated into an outreach and engagement effort through collaboration with extension faculty, and timely and relevant deliverables in this regard will include extension bulletins, workshops, downloadable data, tables, and reports, and other outreach and engagement activities with appropriate clientele. Knowledge disseminated through the aforementioned mechanisms to appropriate decisions makers in various segments of the agricultural sector, government, and in general society is expected to generate an appropriately informed decision environment and sufficient insights into the economic and societal consequences of decisions so that actual decisions made will enhance the sustainability of the agricultural sector, balance the need for uses and preservation of natural resources, and further good stewardship of the environment.

**2. Brief description of the target audience**

The target audience for professional output of the School of Economic Sciences includes decision makers in various segments of the agricultural sector, government policy makers, and the general society. The School,s work will also influence economists in academia nationally and internationally.

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

**Target for the number of persons (contacts) reached through direct and indirect contact methods**

	<b>Direct Contacts Adults</b>	<b>Indirect Contacts Adults</b>	<b>Direct Contacts Youth</b>	<b>Indirect Contacts Youth</b>
<b>Year</b>	<b>Target</b>	<b>Target</b>	<b>Target</b>	<b>Target</b>
<b>Plan</b>	0	0	0	0
2007	658	1242	0	0

**2. Number of Patent Applications Submitted (Standard Research Output)**

**Patent Applications Submitted**

<b>Year</b>	<b>Target</b>
<b>Plan:</b>	0
2007 :	0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

	<b>Extension</b>	<b>Research</b>	<b>Total</b>
<b>Plan</b>			
2007	4	49	53

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Peer reviewed journal articles

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2007	25	49

**Output #2**

**Output Measure**

- Graduate students supported by experiment station and grant funds

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2007	45	32

**V(G). State Defined Outcomes****V. State Defined Outcomes Table of Content**

<b>O No.</b>	<b>OUTCOME NAME</b>
1	Number and Quality/reputation of refereed journal publications (mid-tier economics journals and above
2	Number and quality of other research bulletins, reports and presentations at major conferences
3	Degree of contribution of fundamental knowledge within the fields researched (percent increase)
4	Number and value of external grants in support of the research program (units are dollars)
5	Contribution to improved/new research methods/tools (percent of output)
6	Relevant knowledge generated for use by policy and decision makers (percent of output)
7	Number of graduate students trained and placed in the job market
8	Degree to which overall research funding is increased (percent)
9	Number of additional institutionally funded and externally funded GRAs that are studying and researching in the School

**Outcome #1****1. Outcome Measures**

Number and Quality/reputation of refereed journal publications (mid-tier economics journals and above)

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	25	32

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

There has been a very large influx of young faculty who are just starting their professional careers, and are at the very beginning of the process of publishing in journals.

**What has been done**

Encourage and mentor new faculty regarding publishing in mid-tier journals and above.

**Results**

Demonstrable increase in working paper activity, as well as submissions to journals for article review.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
606	International Trade and Development
901	Program and Project Design, and Statistics
601	Economics of Agricultural Production and Farm Management
605	Natural Resource and Environmental Economics
607	Consumer Economics
610	Domestic Policy Analysis
604	Marketing and Distribution Practices
602	Business Management, Finance, and Taxation
603	Market Economics
609	Economic Theory and Methods

**Outcome #2****1. Outcome Measures**

Number and quality of other research bulletins, reports and presentations at major conferences

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	30	53

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

This is a medium for outreach and engagement, both in terms of state and regional clientele, and for participation in high economics and agricultural economics professions, addressing real world issues and unit reputation.

**What has been done**

Faculty and Graduate Students have actively pursued this medium for disseminating research findings, and incentives are in place for this activity to increase further in the future.

**Results**

Papers were presented at ASSA meeting in New Orleans; there was increased participation at the AAEA and WAEA meetings; SES conducted their first Annual Economic Issues and Outlook Conference in Pasco, WA.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
603	Market Economics
604	Marketing and Distribution Practices
609	Economic Theory and Methods
602	Business Management, Finance, and Taxation
607	Consumer Economics
601	Economics of Agricultural Production and Farm Management
610	Domestic Policy Analysis
901	Program and Project Design, and Statistics
605	Natural Resource and Environmental Economics
606	International Trade and Development

**Outcome #3**

**1. Outcome Measures**

Degree of contribution of fundamental knowledge within the fields researched (percent increase)

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	5	5

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Contributing to the economics and agricultural economics disciplines through expanding the fundamental conceptual knowledge base is necessary for improving the quality and effectiveness of future economic analyses of real world economic problems.

**What has been done**

A number of faculty in SES have successfully pursued basic research contributions in the course of their portfolio of professional activities.

**Results**

Contributions have been made to basic knowledge in economic theory, with future implications for the design of economic models used in researching real world economic issues.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management
609	Economic Theory and Methods

606	International Trade and Development
901	Program and Project Design, and Statistics
607	Consumer Economics
604	Marketing and Distribution Practices
602	Business Management, Finance, and Taxation
603	Market Economics
605	Natural Resource and Environmental Economics
610	Domestic Policy Analysis

**Outcome #4****1. Outcome Measures**

Number and value of external grants in support of the research program  
(units are dollars)

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	750000	1541828

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Expanding external support for the research program of SES is important for expanding the scope of issues that can be researched, as well as the number of graduate assistants that can be supported, and leverages federal dollars.

**What has been done**

The number of grant submissions, and the amount of dollars successfully awarded to SES faculty have both increased. Incentives are in place to further increase submissions in the future.

**Results**

The faculty have responded to the renewed emphasis, which has become an important element of evaluation in annual reviews, by increasing the number of proposals by 14% over 2006.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management
606	International Trade and Development
607	Consumer Economics
901	Program and Project Design, and Statistics
605	Natural Resource and Environmental Economics
602	Business Management, Finance, and Taxation
604	Marketing and Distribution Practices
603	Market Economics
609	Economic Theory and Methods
610	Domestic Policy Analysis

**Outcome #5****1. Outcome Measures**

Contribution to improved/new research methods/tools (percent of output)

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	5	5

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Contributing to the economics and agricultural economics disciplines through developing new research methods and tools leads to improving the quality and effectiveness of future quantitative analyses of real world economic problems.

**What has been done**

A number of faculty in SES have successfully pursued research contributions in econometrics and in nonlinear dynamic modeling methodology in the course of their portfolio of professional activities.

**Results**

Contributions have been made to basic knowledge in econometric theory and nonlinear dynamic modeling, with future implications for the design of quantitative models used in researching real world economic issues.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
605	Natural Resource and Environmental Economics
606	International Trade and Development
901	Program and Project Design, and Statistics
603	Market Economics
601	Economics of Agricultural Production and Farm Management
607	Consumer Economics
610	Domestic Policy Analysis
602	Business Management, Finance, and Taxation
609	Economic Theory and Methods
604	Marketing and Distribution Practices

**Outcome #6****1. Outcome Measures**

Relevant knowledge generated for use by policy and decision makers  
(percent of output)

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	50	75

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Factors affecting the State and Regional markets, economies, and society change, the problems/issues and priorities relating to them change.

**What has been done**

Most of the research projects pursued in SES has been driven by the perceived need for economic intelligence on pressing issues of resource use, sustainability of business enterprises, and government policy affecting the welfare of society in order to inform decision makers about the profitability, efficiency and equity consequences of decisions.

### Results

The faculty have generated a large portfolio of journal articles, reports, presentations, workshops, and a conference to disseminate knowledge directed towards informing policy and decision makers about relevant economic issues.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
603	Market Economics
602	Business Management, Finance, and Taxation
610	Domestic Policy Analysis
609	Economic Theory and Methods
605	Natural Resource and Environmental Economics
607	Consumer Economics
604	Marketing and Distribution Practices
606	International Trade and Development
601	Economics of Agricultural Production and Farm Management
901	Program and Project Design, and Statistics

#### Outcome #7

##### 1. Outcome Measures

Number of graduate students trained and placed in the job market

##### 2. Associated Institution Types

•1862 Research

##### 3a. Outcome Type:

Change in Action Outcome Measure

##### 3b. Quantitative Outcome

Year	Quantitative Target	Actual
2007	12	10

##### 3c. Qualitative Outcome or Impact Statement

###### Issue (Who cares and Why)

Placement of well-trained graduate students increases human capital, and associated high quality research and/or teaching capability at colleges, universities, businesses, and government organizations throughout the nation.

###### What has been done

All faculty in SES are expected to contribute to the disciplinary training of graduate students. In addition, faculty assist graduate students in preparing for job interviews by critiquing presentations, seminars, and research papers.

### Results

In 2007 SES placed several students in academic positions as well as positions in private enterprise.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
605	Natural Resource and Environmental Economics
602	Business Management, Finance, and Taxation
601	Economics of Agricultural Production and Farm Management
604	Marketing and Distribution Practices
607	Consumer Economics
901	Program and Project Design, and Statistics
606	International Trade and Development
609	Economic Theory and Methods
603	Market Economics

**Outcome #8****1. Outcome Measures**

Degree to which overall research funding is increased (percent)

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	10	14

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Increasing the overall level of research funding expands the scope of issues that can be addressed by the research programs of the SES faculty, allowing more priority issues to be explicitly addressed. This also allows for an expansion in the number of graduate students supported and trained.

**What has been done**

There has been a renewed emphasis on pursuing additional research funding support by all faculty in SES. This has been affected by both fostering an understanding of its importance, and through explicit incentives in annual reviews.

**Results**

SES faculty have increased the number of grant proposals submitted.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
607	Consumer Economics
609	Economic Theory and Methods
901	Program and Project Design, and Statistics
602	Business Management, Finance, and Taxation
605	Natural Resource and Environmental Economics
606	International Trade and Development
610	Domestic Policy Analysis
603	Market Economics
601	Economics of Agricultural Production and Farm Management
604	Marketing and Distribution Practices

**Outcome #9****1. Outcome Measures**

Number of additional institutionally funded and externally funded GRAs that are studying and researching in the School

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	3	11

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Funding GRA's is essential for maintaining research capacity in the School, as well as to maintain a critical mass of graduate students in order to have a vigorous and sustainable graduate program.

**What has been done**

The frequency and amounts of graduate student funding requests have increased in recent grant proposals submitted by faculty in the School.

**Results**

External funding for GRAs has fallen from the previous year. This has been offset somewhat by an increase in funded GRAs procured in competitive grants awarded from IMPACT and from the Graduate School of the University.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
606	International Trade and Development
604	Marketing and Distribution Practices
605	Natural Resource and Environmental Economics
601	Economics of Agricultural Production and Farm Management
602	Business Management, Finance, and Taxation
901	Program and Project Design, and Statistics
607	Consumer Economics
609	Economic Theory and Methods
603	Market Economics
610	Domestic Policy Analysis

**V(H). Planned Program (External Factors)****External factors which affected outcomes**

- Economy
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges

**Brief Explanation****V(I). Planned Program (Evaluation Studies and Data Collection)****1. Evaluation Studies Planned**

- Before-After (before and after program)
- During (during program)

**Evaluation Results**

Prior to the start of any program, each Hatch project proposal that is submitted to the Director of the School is first subjected to a peer review by a minimum of two other PhD economists in or outside of the SES, the objective being to evaluate the relevance of the proposed problems or issues to be researched by the project, to evaluate the command of the problem context and the relevant literature by the proposer, to check the appropriateness of the proposed research methodology to be used in addressing the problems or issues stated, and finally, to verify the adequacy of the stated outcomes of the research relative to the goals stated in the proposal. During the time when the program is active, the progress of each faculty member with a Hatch project is reviewed annually by the Director of the School, followed by the Dean and Directors of the College of Agricultural, Human and Natural Resource Sciences. Measures of progress on Hatch projects include the number of refereed journal articles produced, the quality of refereed journal articles produced, the quantity and quality of other peer and non-peer reviewed research bulletins, reports and presentations generated, the level of extramural funding received from external sources in support of the research program, and the number of masters and doctoral students completing their degrees that have theses or dissertations that in part, or in whole, contribute research addressing the goals set forth in the Hatch project proposal. Also considered is the degree to which program research results have been disseminated effectively to clientele through outreach and engagement efforts, the latter often in collaboration with Extension faculty. At the completion of the project term, the Director evaluates the final termination report of the Hatch project provided by the faculty member for the degree of success achieved in meeting the original stated goals and objectives of the Hatch project, and interacts with the faculty member regarding this progress as appropriate. To the extent that the project was externally funded, the degree to which the funding institution, agency or commission expresses satisfaction with the usefulness and completeness of the research outcomes for addressing the problems or issues of concern is another dimension of the post-project evaluation of research projects.

**Key Items of Evaluation**

**Program #7****V(A). Planned Program (Summary)****1. Name of the Planned Program**

Program in Statistics

**V(B). Program Knowledge Area(s)****1. Program Knowledge Areas and Percentage**

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
901	Program and Project Design, and Statistics			100%	
	<b>Total</b>			100%	

**V(C). Planned Program (Inputs)****1. Actual amount of professional FTE/SYs expended this Program**

Year: 2007	Extension		Research	
	1862	1890	1862	1890
<b>Plan</b>	0.0	0.0	1.5	0.0
<b>Actual</b>	0.0	0.0	1.0	0.0

**2. Actual dollars expended in this Program (includes Carryover Funds from previous years)**

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	8788	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	101926	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	32861	0

**V(D). Planned Program (Activity)****1. Brief description of the Activity**

The project on binary data analysis deals with the development of better methods to analyze data arising from randomized complete block experiments where the treatments being studied have a factorial structure. The results of this project will allow animal and plant scientists to more efficiently design such experiments as well as obtain more information from data generated. The project on the evaluation of methods to analyze resource selection data is designed to determine which resource allocation data techniques work best in differing circumstances. In particular, a generalized linear mixed model approach to analyzing data from resources allocation problems having a spatial component was compared to techniques that use a multiple logistic regression framework. The results obtained from this research will help wildlife managers make more intelligent decisions about how to distribute resources based on available data.

**2. Brief description of the target audience**

The target audience is other academic staticians, biologists and scientists other disciplines who are consumers of knowledge concerning statistical functions.

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

**Target for the number of persons (contacts) reached through direct and indirect contact methods**

	<b>Direct Contacts Adults</b>	<b>Indirect Contacts Adults</b>	<b>Direct Contacts Youth</b>	<b>Indirect Contacts Youth</b>
<b>Year</b>	<b>Target</b>	<b>Target</b>	<b>Target</b>	<b>Target</b>
<b>Plan</b>	0	0	0	0
2007	20	40	0	0

**2. Number of Patent Applications Submitted (Standard Research Output)**

**Patent Applications Submitted**

<b>Year</b>	<b>Target</b>
<b>Plan:</b>	0
2007 :	0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

	<b>Extension</b>	<b>Research</b>	<b>Total</b>
<b>Plan</b>			
2007	0	1	1

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Peer reviewed publications

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2007	2	1

**V(G). State Defined Outcomes****V. State Defined Outcomes Table of Content**

<b>O No.</b>	<b>OUTCOME NAME</b>
1	Immediate dissemination of knowledge gained from research projects through talks presented and peer reviewed publications
2	Number of peer reviewed journal and proceedings papers, number of talks given
3	Implementation of statistical methodologies and procedures derived from individual research projects in our department by other scientists
4	Number of citations for articles published which are based on individual research projects

**Outcome #1****1. Outcome Measures**

Immediate dissemination of knowledge gained from research projects through talks presented and peer reviewed publications

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	2	1

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
901	Program and Project Design, and Statistics

**Outcome #2****1. Outcome Measures**

Number of peer reviewed journal and proceedings papers, number of talks given

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	2	1

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
901	Program and Project Design, and Statistics

**Outcome #3****1. Outcome Measures**

Implementation of statistical methodologies and procedures derived from individual research projects in our department by other scientists

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	2	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
901	Program and Project Design, and Statistics

**Outcome #4****1. Outcome Measures**

Number of citations for articles published which are based on individual research projects

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	2	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
901	Program and Project Design, and Statistics

**V(H). Planned Program (External Factors)**

**External factors which affected outcomes**

- Other (None)

**Brief Explanation**

**V(I). Planned Program (Evaluation Studies and Data Collection)**

**1. Evaluation Studies Planned**

- During (during program)

**Evaluation Results**

**Key Items of Evaluation**

**Program #8****V(A). Planned Program (Summary)****1. Name of the Planned Program**

Program in Community and Rural Sociology

**V(B). Program Knowledge Area(s)****1. Program Knowledge Areas and Percentage**

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
608	Community Resource Planning and Development			6%	
803	Sociological and Technological Change Affecting Individuals, Families and Communities			62%	
805	Community Institutions, Health, and Social Services			32%	
	<b>Total</b>			100%	

**V(C). Planned Program (Inputs)****1. Actual amount of professional FTE/SYs expended this Program**

Year: 2007	Extension		Research	
	1862	1890	1862	1890
<b>Plan</b>	0.0	0.0	2.0	0.0
<b>Actual</b>	0.0	0.0	4.0	0.0

**2. Actual dollars expended in this Program (includes Carryover Funds from previous years)**

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	51805	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	384702	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	90270	0

**V(D). Planned Program (Activity)****1. Brief description of the Activity**

The main thrust of the department's program activities is in the area of human dimensions of sustainable agricultural development. During 2007, research was completed on gender issues in Washington agriculture, including a special project on gender issues in organic agriculture. Research and outreach also took place in minority issues in Washington agriculture, particularly with Hispanic and Hmong agricultural producers. The department continued to utilize its website for the dissemination of research results (e.g. please see <http://www.crs.wsu.edu/outreach/rj/agsurvey/index.html> and <http://www.crs.wsu.edu/outreach/rj/agconsumer/index.html>) from recent as well as earlier research. This includes the results of the studies on gender issues, as well as surveys of wheat producers and of state-wide producer and consumer surveys in Washington State. Other departmental activities include work with survey designers at the National Science Foundation, the Government Accountability Office, the U.S. Bureau of the Census and the Bureau of Labor Statistics to design more efficient surveys with less measurement bias. Finally, work was begun in 2007 on the transition of rural communities in the Pacific Northwest from a natural resource to a tourism/amenity base.

**2. Brief description of the target audience**

The target audience will include other social scientists, persons interested in sustainable agriculture, communities, agri-businesses, demographers and policy makers.

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

**Target for the number of persons (contacts) reached through direct and indirect contact methods**

	<b>Direct Contacts Adults</b>	<b>Indirect Contacts Adults</b>	<b>Direct Contacts Youth</b>	<b>Indirect Contacts Youth</b>
<b>Year</b>	<b>Target</b>	<b>Target</b>	<b>Target</b>	<b>Target</b>
<b>Plan</b>	0	0	0	0
2007	1230	8760	0	0

**2. Number of Patent Applications Submitted (Standard Research Output)**

**Patent Applications Submitted**

<b>Year</b>	<b>Target</b>
<b>Plan:</b>	0
2007 :	0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

	<b>Extension</b>	<b>Research</b>	<b>Total</b>
<b>Plan</b>			
2007	0	5	5

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Peer reviewed journal articles

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2007	5	5

**Output #2**

**Output Measure**

- Graduate students supported by Agricultural Research Center funds including grants

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2007	2	2

**V(G). State Defined Outcomes****V. State Defined Outcomes Table of Content**

<b>O No.</b>	<b>OUTCOME NAME</b>
1	Steady increase in the number of state residents accessing bulletins and other stakeholder directed publications via the department website
2	Steady increase in number of state residents accessing survey results via the department website

**Outcome #1****1. Outcome Measures**

Steady increase in the number of state residents accessing bulletins and other stakeholder directed publications via the department website

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	2250	7591

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Sustainable development of rural communities is crucial for local residents.

**What has been done**

Info on natural and human resource base shared with local policy makers.

**Results**

Pros and Cons of alternative development strategies, like tourism, have been identified and incorporated into plans.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
803	Sociological and Technological Change Affecting Individuals, Families and Communities
805	Community Institutions, Health, and Social Services
608	Community Resource Planning and Development

**Outcome #2****1. Outcome Measures**

Steady increase in number of state residents accessing survey results via the department website

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	500	964

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Family operated farm families and community groups who support local food systems for healthy communities.

**What has been done**

Surveys of farm family members

**Results**

Needs of minority and women farmers, and of farmers' markets, identified and incorporated into plans.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
803	Sociological and Technological Change Affecting Individuals, Families and Communities
608	Community Resource Planning and Development
805	Community Institutions, Health, and Social Services

#### V(H). Planned Program (External Factors)

##### External factors which affected outcomes

- Economy
- Public Policy changes
- Government Regulations
- Competing Public priorities

##### Brief Explanation

#### V(I). Planned Program (Evaluation Studies and Data Collection)

##### 1. Evaluation Studies Planned

- Retrospective (post program)
- During (during program)
- Comparisons between program participants (individuals,group,organizations) and non-participants

##### Evaluation Results

The program is currently implementing a strategy for gauging the effectiveness of using the web to share information.

##### Key Items of Evaluation

**Program #9**

**V(A). Planned Program (Summary)**

**1. Name of the Planned Program**

Program in Agricultural Animal Health

**V(B). Program Knowledge Area(s)**

**1. Program Knowledge Areas and Percentage**

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
307	Animal Management Systems			10%	
308	Improved Animal Products (Before Harvest)			10%	
311	Animal Diseases			10%	
312	External Parasites and Pests of Animals			10%	
313	Internal Parasites in Animals			10%	
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals			10%	
403	Waste Disposal, Recycling, and Reuse			10%	
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources			10%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins			10%	
722	Zoonotic Diseases and Parasites Affecting Humans			10%	
	<b>Total</b>			100%	

**V(C). Planned Program (Inputs)**

**1. Actual amount of professional FTE/SYs expended this Program**

Year: 2007	Extension		Research	
	1862	1890	1862	1890
<b>Plan</b>	0.0	0.0	1.8	0.0
<b>Actual</b>	0.0	0.0	2.0	0.0

**2. Actual dollars expended in this Program (includes Carryover Funds from previous years)**

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	9930	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	263722	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	29011	0

**V(D). Planned Program (Activity)**

**1. Brief description of the Activity**

Genetic strain types of *E. coli* O157:H7 isolated from clinical cases and from cattle feces (as a measure of the strains circulating in the reservoir), ground beef (as a measure of strains contaminating foods), and from untreated human sewage (as an indirect measure of all strains--not just virulent strains--passing through humans) were compared. We have searched for emergence of new salmonella strains in our regions to identify the location(s) where antibiotic resistant strains are selected. We identified a new clonal strain of Salmonella that is epidemic in the Pacific Northwest and are working to identify the means of transmission. We documented a high degree of multi-drug resistance in serovar Dublin isolated from dairy farms and heifer ranches, indicating selection pressure for increased resistance is more likely occurring on these types of farms with the host specificity of this serovar. The coagulase negative staphylococci (CNS) are the most prevalent mastitis pathogen and maybe misidentified as minor pathogens. Yet many species of this genus possess enterotoxin genomes and have other virulence factors. We are comparing the accuracy of phenotypic vs. genotypic ( gap gene PCR-RFLP) speciation methods in the identification of CNS isolates. Considering reference strain identification, *S. aureus* ATCC 29740, *S. capitis* ATCC 35661, *S. epidermidis* ATCC 12228, *S. sciuri* ATCC 29060 and *S. xylosum* ATCC 29971 were identified correctly with ~95% probability. However, *S. haemolyticus* ATCC 29970 and *S. intermedius* ATCC 29663 were not correctly identified by the API STAPH commercial kit. However, gap gene PCR-RFLP correctly identified all reference strains. Only 34 out of 68 CNS isolates (50%) were identified by API STAPH commercial kit with ~80% identification accuracy. Mycoplasma mastitis normally begins with high prevalence, followed by a lower herd prevalence. A longitudinal study of the recurrence mycoplasma mastitis in the same herd for 1 year period will provide the information to understand the epidemiology of the disease. The objective of this study was to determine the epidemiology of the recurrence of mycoplasma mastitis to a herd as investigated by culture of bulk milk. We found: The percentage of farms with a recurrence of mycoplasma mastitis was 57.5% (n=23/40), average number of the recurrences was 2.45, and the bulk milk samples from 4 herds that were examined in the same month of a first positive culture of Mycoplasma spp. were negative at the second test, as opposed to the 6 herds also tested twice in the same month that remained positive. Cattle from 4 herds were enrolled in the study to test the hypothesis that cows given a theoretical dry period of 45 or 60 day (long) would have fewer intramammary infections than cows given a theoretical dry period of 30 d (short). The risk of acquiring a new IMI during the dry period was not statistically different (P=0.53) between treatments (45 or 60 day dry periods). Mammary quarters that cured during a long dry period (73%) was not statistically different (P=0.54) compared to mammary quarters that cured during a short dry period.

**2. Brief description of the target audience**

Our target audience includes academicians, clinicians, microbiologists, public health authorities, practicing veterinarians, farmers and the general public.

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

**Target for the number of persons (contacts) reached through direct and indirect contact methods**

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
Plan	0	0	0	0
2007	2000	10000	0	0

**2. Number of Patent Applications Submitted (Standard Research Output)**

**Patent Applications Submitted**

<b>Year</b>	<b>Target</b>
Plan:	0
2007 :	0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

	<b>Extension</b>	<b>Research</b>	<b>Total</b>
<b>Plan</b>			
2007	0	16	16

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Peer reviewed journal articles

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2007	9	16

**Output #2**

**Output Measure**

- Graduate students supported on agricultural research center funds and grants

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2007	4	8

**V(G). State Defined Outcomes****V. State Defined Outcomes Table of Content**

<b>O No.</b>	<b>OUTCOME NAME</b>
1	Define natural occurrence and shedding patterns of E. coli O157:H7
2	Determine the extent of Salmonella typhimurium DT 104 as an emerging and zoonotic pathogen
3	Develop PCR test for mycoplasma mastitis in milk samples
4	Reduce prevalence of Mycoplasma mastitis in dairy herds from the current 8 percent to 2 percent of herds
5	Research support in dollars for the project on E. coli O157:H7
6	Assess Epidemiology of Micoplasma Mastitis

**Outcome #1****1. Outcome Measures**

Define natural occurrence and shedding patterns of E. coli O157:H7

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	1	2

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

E. coli O157:H7 is a zoonotic agent that results in an estimated 70,000 or more cases per year in the US alone. Cattle are the major reservoir of this bacterium and human cases result from direct or indirect (food-borne) contact with the agent. This disease is therefore of major concern for physicians, public health workers, food producers and processors, veterinarians, feedlot operators, and ranchers.

**What has been done**

We compared genetic strain types of E. coli O157:H7 isolated from clinical cases with those isolated from cattle feces (as a measure of the strains circulating in the reservoir), ground beef (as a measure of strains contaminating foods), and from untreated human sewage (as an indirect measure of all strains - not just virulent strains - passing through humans).

**Results**

Clinical isolates represented a distinct subset of cattle strain types.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
722	Zoonotic Diseases and Parasites Affecting Humans
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

**Outcome #2****1. Outcome Measures**

Determine the extent of Salmonella typhimurium DT 104 as an emerging and zoonotic pathogen

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	1	2

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Salmonella represent one of the top two bacterial foodborne infections of humans. Salmonella strains with multiple antibiotic resistance of of particular concern as they result in increased morbidity, and these strains seem to be particularly shared between cattle and humans. Therefore, understanding of the source and dissemination of this agent is of concern for physicians, public health workers, food producers and processors, veterinarians, feedlot operators, and ranchers.

#### What has been done

We have searched for emergence of new salmonella strains in our regions and attempted to identify the location(s) where antibiotic resistant strains are selected.

#### Results

We identified a new clonal strain of Salmonella that is epidemic in the pacific northwest and are working to identify the means by which it is spread. We have also documented the high degree of multi-drug resistance in serovar Dublin isolated from dairy farms and heifer ranches, which indicates that the selection pressure for increased resistance is more likely occurring on these types of farms given the high degree of host specificity of this serovar.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
722	Zoonotic Diseases and Parasites Affecting Humans
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sourc

#### Outcome #3

##### 1. Outcome Measures

Develop PCR test for mycoplasma mastitis in milk samples

##### 2. Associated Institution Types

•1862 Research

##### 3a. Outcome Type:

Change in Knowledge Outcome Measure

##### 3b. Quantitative Outcome

Year	Quantitative Target	Actual
2007	1	2

##### 3c. Qualitative Outcome or Impact Statement

###### Issue (Who cares and Why)

Salmonella represent one of the top two bacterial foodborne infections of humans. Salmonella strains with multiple antibiotic resistance of of particular concern as they result in increased morbidity, and these strains seem to be particularly shared between cattle and humans. Therefore, understanding of the source and dissemination of this agent is of concern for physicians, public health workers, food producers and processors, veterinarians, feedlot operators, and ranchers.

#### What has been done

We have searched for emergence of new salmonella strains in our regions and attempted to identify the location(s) where antibiotic resistant strains are selected.

#### Results

We identified a new clonal strain of Salmonella that is epidemic in the pacific northwest and are working to identify the means by which it is spread. We have also documented the high degree of multi-drug resistance in serovar Dublin isolated from dairy farms and heifer ranches, which indicates that the selection pressure for increased resistance is more likely occurring on these types of farms given the high degree of host specificity of this serovar.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sourc
722	Zoonotic Diseases and Parasites Affecting Humans

**Outcome #4****1. Outcome Measures**

Reduce prevalence of Mycoplasma mastitis in dairy herds from the current 8 percent to 2 percent of herds

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	0	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

changed to Assess Epidemiology of Micoplasma Mastitis ; see added outcome.

**What has been done****Results****4. Associated Knowledge Areas**

KA Code	Knowledge Area
308	Improved Animal Products (Before Harvest)
311	Animal Diseases
307	Animal Management Systems

**Outcome #5****1. Outcome Measures**

Research support in dollars for the project on E. coli O157:H7

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	50000	153152

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)****What has been done**

**Results****4. Associated Knowledge Areas**

KA Code	Knowledge Area
722	Zoonotic Diseases and Parasites Affecting Humans
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

**Outcome #6****1. Outcome Measures**

Assess Epidemiology of *Mycoplasma Mastitis*

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	{No Data Entered}	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

*Mycoplasma* sp. that cause mastitis are emerging mastitis pathogens. Recent reports from Washington State University and the National Animal Health Monitoring Service concur that emergence of this disease is correlated with increasing herd size. The US dairy population is likely to continue to suffer from an increase in this disease as average herd size continues to increase in the nation. *Mycoplasma mastitis* normally begins with high prevalence and then a decreasing herd prevalence. *Mycoplasma mastitis* is an insidious disease given problems in diagnosis and the propensity for asymptomatic carriage of the agent in cattle on the farm.

**What has been done**

A longitudinal study of the recurrence *mycoplasma mastitis* in the same herds for 1 year period was done to provide the information to understand the epidemiology of the disease. With a better understanding of the disease process better intervention strategies can be developed to reduce the incidence and thus prevalence of the disease.

**Results**

It was determined that the percentage of farms with a recurrence of *mycoplasma mastitis* was 57.5% (n=23/40), the average number of the recurrences was 2.45, and that bulk milk samples from 4 herds that were examined in the same month of a first positive culture of *Mycoplasma* spp. were negative at the second test, as opposed to the 6 herds also tested twice in the same month that remained positive.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
311	Animal Diseases
308	Improved Animal Products (Before Harvest)
307	Animal Management Systems

**V(H). Planned Program (External Factors)**

External factors which affected outcomes

- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges

**Brief Explanation**

**V(l). Planned Program (Evaluation Studies and Data Collection)**

**1. Evaluation Studies Planned**

- Before-After (before and after program)
- During (during program)

**Evaluation Results**

The program is currently implementing a strategy for gauging the effectiveness of using the web to share information.

**Key Items of Evaluation**

**Program #10**

**V(A). Planned Program (Summary)**

**1. Name of the Planned Program**

Program in Fruit and Vegetable Development, Production and Management

**V(B). Program Knowledge Area(s)**

**1. Program Knowledge Areas and Percentage**

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
201	Plant Genome, Genetics, and Genetic Mechanisms			8%	
202	Plant Genetic Resources			10%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants			13%	
204	Plant Product Quality and Utility (Preharvest)			28%	
205	Plant Management Systems			23%	
206	Basic Plant Biology			7%	
212	Pathogens and Nematodes Affecting Plants			3%	
216	Integrated Pest Management Systems			1%	
404	Instrumentation and Control Systems			4%	
601	Economics of Agricultural Production and Farm Management			1%	
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources			2%	
	<b>Total</b>			100%	

**V(C). Planned Program (Inputs)**

**1. Actual amount of professional FTE/SYs expended this Program**

Year: 2007	Extension		Research	
	1862	1890	1862	1890
<b>Plan</b>	0.0	0.0	41.7	0.0
<b>Actual</b>	0.0	0.0	34.0	0.0

**2. Actual dollars expended in this Program (includes Carryover Funds from previous years)**

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	316567	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	1119696	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	1639328	0

**V(D). Planned Program (Activity)**

**1. Brief description of the Activity**

Specific activities vary across a wide range from molecular level inquiry to field based studies concerning the efficacy of horticultural production practices. These activities include: (1) basic research applying molecular biology, genetics and biochemistry to the calcium/calmodulin-mediated signal network that influences plant response to environmental factors; (2) development of data mining tools and resources for genomics research on Rosaceae; (3) studies in fruit production and biology, with an emphasis on sustainability of fruit production systems; (4) breeding and genetic studies in apple, cherry, raspberry, and strawberry, including genomics approaches to identify functional genetic markers for crop improvement; (5) studies of the anatomy and structure of grape berry during growth and development; (6) research that emphasizes the use of plant bioregulators for apple, pear, and sweet cherry, (7) studies related to the interaction of various environmental and production factors influencing yield and quality of potato tubers; (8) research focusing on environmental factors and management practices as they influence grape physiology; (9) studies of effects of deficit irrigation and partial root zone drying in apple, cherry, and grape; (10) research which focuses on the development of an understanding of factors that cause skin disorders of apples; (11) evaluation of potato cultivars for introduction into the Washington potato industry; (12) studies focusing on practical means of achieving balanced cropping; (13) effects of new clonal rootstocks on scion productivity, growth, and fruit quality in cherry; (14) research focusing on novel management strategies for high density cherry production; (15) the potential for mechanical harvest of fresh-market quality, stemless sweet cherries; and (16) the development of automation, sensing, control, and information systems for precision agriculture. The outputs of these activities will include: patents, plant variety releases, scientific journal articles, conference publications and presentations, poster presentations, field day presentations, web sites, and knowledge about production and management practices that is passed along to users in other informal settings.

**2. Brief description of the target audience**

The audience for this program will be other scientists, economists, agribusiness, farmers, horticulturists and the fruit tree and potato industries.

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

**Target for the number of persons (contacts) reached through direct and indirect contact methods**

	<b>Direct Contacts Adults</b>	<b>Indirect Contacts Adults</b>	<b>Direct Contacts Youth</b>	<b>Indirect Contacts Youth</b>
<b>Year</b>	<b>Target</b>	<b>Target</b>	<b>Target</b>	<b>Target</b>
<b>Plan</b>	0	0	0	0
2007	0	0	0	0

**2. Number of Patent Applications Submitted (Standard Research Output)**

**Patent Applications Submitted**

<b>Year</b>	<b>Target</b>
<b>Plan:</b>	1
2007 :	2

**Patents listed**

Poovaiah B., L. Du. 2007. Size and/or growth engineering by modulation of the interaction between calmodulin, and brassinosteroid biosynthetic enzymes and orthologs thereof. submitted.  
 Schrader, L.E. 2007. Compositions and methods for suppressing cracking and water loss from cherries. U.S. Patent no. 7,222,445

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

	<b>Extension</b>	<b>Research</b>	<b>Total</b>
<b>Plan</b>			
2007	2	22	24

**V(F). State Defined Outputs****Output Target****Output #1****Output Measure**

- Peer reviewed journal articles

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2007	20	22

**Output #2****Output Measure**

- Variety Releases

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2007	2	4

**Output #3****Output Measure**

- Plant Patents

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2007	1	4

**Output #4****Output Measure**

- Number of graduate students supported by Agricultural Research Center and external funds

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2007	7	19

**V(G). State Defined Outcomes****V. State Defined Outcomes Table of Content**

O No.	OUTCOME NAME
1	See below under Evaluation.

**Outcome #1****1. Outcome Measures**

See below under Evaluation.

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	0	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)****What has been done****Results**

Breeding and development of potato varieties that are more efficient in nitrogen use (Pacific Northwest Potato Variety Development Program, PNWPVD) has reduced the use of nitrogen, resulting in less nitrate contamination of ground water. The potential economic savings to NW potato growers was estimated to be \$1.3 million or \$72 per acre in 2006. Varieties released by this collaborative program accounted for 26% and 32% of potato acreage in the Pacific Northwest and WA in 2007, respectively. Farm-gate value of these new varieties in WA in 2007 is estimated to be \$160,000,000. It is estimated that the potato varieties developed by the PNWPVD program have returned \$39 for every dollar (research & institutional) invested.

Other researchers in this program have identified the process that causes sun burning in apples, and have developed a product that reduces this disorder significantly. This discovery has the potential to save fruit growers literally tens of millions of dollars annually. It is estimated that the patented apple sunburn protectant (RAYNOX,®) alone saved the industry several million dollars during the past three growing seasons. The invention of RainGard to aid in the protection of cherries from cracking/splitting is also expected to have tremendous positive economic impact on the industry.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
205	Plant Management Systems
206	Basic Plant Biology
601	Economics of Agricultural Production and Farm Management
201	Plant Genome, Genetics, and Genetic Mechanisms
204	Plant Product Quality and Utility (Preharvest)
202	Plant Genetic Resources
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants

**V(H). Planned Program (External Factors)****External factors which affected outcomes**

- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration,new cultural groupings,etc.)

**Brief Explanation**

See above.

**V(l). Planned Program (Evaluation Studies and Data Collection)**

**1. Evaluation Studies Planned**

- Retrospective (post program)
- Before-After (before and after program)
- During (during program)

**Evaluation Results**

**Key Items of Evaluation**

**Program #11****V(A). Planned Program (Summary)****1. Name of the Planned Program**

Program in the Post Harvest Quality of Fruits and Vegetables

**V(B). Program Knowledge Area(s)****1. Program Knowledge Areas and Percentage**

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
201	Plant Genome, Genetics, and Genetic Mechanisms			10%	
202	Plant Genetic Resources			10%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants			10%	
204	Plant Product Quality and Utility (Preharvest)			10%	
205	Plant Management Systems			10%	
206	Basic Plant Biology			10%	
501	New and Improved Food Processing Technologies			10%	
502	New and Improved Food Products			10%	
503	Quality Maintenance in Storing and Marketing Food Products			10%	
701	Nutrient Composition of Food			10%	
	<b>Total</b>			100%	

**V(C). Planned Program (Inputs)****1. Actual amount of professional FTE/SYs expended this Program**

Year: 2007	Extension		Research	
	1862	1890	1862	1890
<b>Plan</b>	0.0	0.0	11.5	0.0
<b>Actual</b>	0.0	0.0	13.0	0.0

**2. Actual dollars expended in this Program (includes Carryover Funds from previous years)**

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	131598	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	492310	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	697204	0

**V(D). Planned Program (Activity)****1. Brief description of the Activity**

Specific activities and outputs vary across a wide range from molecular level inquiry to field and lab based studies related to postharvest handling, storage, and processing of horticultural crops. These activities will include: basic research which focuses on the application of molecular biology, genetics and biochemistry, related to the biological, chemical, and physiological mechanisms that explain postharvest phenomena in horticultural crops, studies directed at the identification of CA storage regimes for apples and other fruits, investigation of flavor chemistry in apples, studies of the post-harvest/processing quality attributes of potatoes in the Tri-State Variety trials, research to identify factors that affect storability and processing quality of potatoes, research directed toward the identification of strategies for storage of seed potatoes, research focused on the mechanical harvest and subsequent handling and storage requirements in asparagus, studies which address the use of microwave-vacuum drying technology for fruits and vegetables, studies which focus on lenticel breakdown and fruit finish in apples, and research which focuses on crop management factors that affect postharvest fruit and vegetable quality.

**2. Brief description of the target audience**

The target audience will be scientists in the area of postharvest quality of fruits and vegetables, agribusiness, economists, and the participating vegetable and fruit industries (in particular the stone and pome fruit industries, and the potato industry).

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

**Target for the number of persons (contacts) reached through direct and indirect contact methods**

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
Plan	0	0	0	0
2007	0	0	0	0

**2. Number of Patent Applications Submitted (Standard Research Output)**

**Patent Applications Submitted**

Year	Target
Plan:	1
2007 :	1

**Patents listed**

Knowles, N.R. and L.O. Knowles. 2007. Use of C3 to C14 aliphatic aldehydes, ketones, and primary and secondary C3 to C7 alcohols to inhibit sprouting of potato tubers. Provisional Patent U.S. 60/955,156 filed Aug. 10.

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

	Extension	Research	Total
Plan			
2007	1	22	23

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Peer reviewed journal articles

Year	Target	Actual
2007	12	22

**Output #2**

**Output Measure**

- Graduate students supported on Agricultural Research Center and external funding

Year	Target	Actual
2007	4	6

**V(G). State Defined Outcomes****V. State Defined Outcomes Table of Content**

O No.	OUTCOME NAME
1	Please see written paragraph under evaluation.

**Outcome #1****1. Outcome Measures**

Please see written paragraph under evaluation.

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	0	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
206	Basic Plant Biology
501	New and Improved Food Processing Technologies
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
701	Nutrient Composition of Food
503	Quality Maintenance in Storing and Marketing Food Products
502	New and Improved Food Products
204	Plant Product Quality and Utility (Preharvest)

**V(H). Planned Program (External Factors)****External factors which affected outcomes**

- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges

**Brief Explanation****V(I). Planned Program (Evaluation Studies and Data Collection)****1. Evaluation Studies Planned**

- Before-After (before and after program)
- During (during program)

**Evaluation Results**

**Key Items of Evaluation**

**Program #12**

**V(A). Planned Program (Summary)**

**1. Name of the Planned Program**

Program in Environmental Horticulture

**V(B). Program Knowledge Area(s)**

**1. Program Knowledge Areas and Percentage**

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
124	Urban Forestry			10%	
134	Outdoor Recreation			10%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants			25%	
212	Pathogens and Nematodes Affecting Plants			25%	
724	Healthy Lifestyle			10%	
802	Human Development and Family Well-Being			10%	
804	Human Environmental Issues Concerning Apparel, Textiles, and Residential and Commercial Structures			10%	
<b>Total</b>				100%	

**V(C). Planned Program (Inputs)**

**1. Actual amount of professional FTE/SYs expended this Program**

Year: 2007	Extension		Research	
	1862	1890	1862	1890
<b>Plan</b>	0.0	0.0	3.3	0.0
<b>Actual</b>	0.0	0.0	17.0	0.0

**2. Actual dollars expended in this Program (includes Carryover Funds from previous years)**

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	160517	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	603078	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	1267847	0

**V(D). Planned Program (Activity)**

**1. Brief description of the Activity**

Specific activities that are part of this program include: investigations of the effects of cultural practices on plant root health and the establishment of landscape plants, research focusing on the development of an understanding of environmental and cultural factors that affect water stress and cold hardiness in landscape plants, research focusing on the identification of superior ornamental landscape plants for urban environments, studies of the influence of human experience in the development of perceptions related to urban landscapes, and research aimed at developing further understanding of the relationships between physical environments and human behavior.

**2. Brief description of the target audience**

The target audience for this program consists of other scientists in the discipline, extension personnel, social scientists, landscape horticulture industry, and the consumer/gardener.

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

**Target for the number of persons (contacts) reached through direct and indirect contact methods**

	<b>Direct Contacts Adults</b>	<b>Indirect Contacts Adults</b>	<b>Direct Contacts Youth</b>	<b>Indirect Contacts Youth</b>
<b>Year</b>	<b>Target</b>	<b>Target</b>	<b>Target</b>	<b>Target</b>
<b>Plan</b>	0	0	0	0
2007	0	0	0	0

**2. Number of Patent Applications Submitted (Standard Research Output)**

**Patent Applications Submitted**

<b>Year</b>	<b>Target</b>
<b>Plan:</b>	0
2007 :	0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

	<b>Extension</b>	<b>Research</b>	<b>Total</b>
<b>Plan</b>			
2007	1	4	5

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Peer reviewed journal articles

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2007	8	4

**V(G). State Defined Outcomes****V. State Defined Outcomes Table of Content**

<b>O No.</b>	<b>OUTCOME NAME</b>
1	See below under Evaluation.

**Outcome #1****1. Outcome Measures**

See below under Evaluation.

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	0	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
724	Healthy Lifestyle
124	Urban Forestry
802	Human Development and Family Well-Being

**V(H). Planned Program (External Factors)****External factors which affected outcomes**

- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration,new cultural groupings,etc.)

**Brief Explanation****V(I). Planned Program (Evaluation Studies and Data Collection)****1. Evaluation Studies Planned**

- Before-After (before and after program)
- During (during program)

**Evaluation Results****Key Items of Evaluation**

**Program #13**

**V(A). Planned Program (Summary)**

**1. Name of the Planned Program**

Program in Entomology

**V(B). Program Knowledge Area(s)**

**1. Program Knowledge Areas and Percentage**

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
121	Management of Range Resources			2%	
135	Aquatic and Terrestrial Wildlife			2%	
136	Conservation of Biological Diversity			3%	
211	Insects, Mites, and Other Arthropods Affecting Plants			20%	
215	Biological Control of Pests Affecting Plants			15%	
216	Integrated Pest Management Systems			35%	
304	Animal Genome			8%	
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sourc			15%	
	<b>Total</b>			100%	

**V(C). Planned Program (Inputs)**

**1. Actual amount of professional FTE/SYs expended this Program**

Year: 2007	Extension		Research	
	1862	1890	1862	1890
<b>Plan</b>	0.0	0.0	58.2	0.0
<b>Actual</b>	0.0	0.0	49.0	0.0

**2. Actual dollars expended in this Program (includes Carryover Funds from previous years)**

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	192072	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	1692166	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	2552528	0

**V(D). Planned Program (Activity)**

**1. Brief description of the Activity**

Both basic and applied research will be conducted. Results of research efforts will be disseminated through refereed publications, general interest publications, Extension and commodity outlets, as well as presentations at scientific, stakeholder, and general public venues. A minimal amount of infrastructure will be constructed and equipment will be purchased during the plan of work period. All programs will involve the training of graduate students. Specific activities will include or produce: A better understanding of biological diversity of native and disturbed habitats in Washington and the greater Pacific Northwest; Specimens collected and prepared during studies will be deposited in the James Entomological Collection; Studies of native and exotic species of arthropods in order to evaluate their potential for the control of and impact upon non-native, rangeland weed species; Studies directed at the management of direct and indirect pests through traditional technologies; Studies of basic biological and ecological principles as they relate to the management of pest and beneficial arthropods; Development and implementation of biological control and integrated pest management strategies for the management of pest arthropods, especially insects; Genomic studies of primarily honey bees and parasitic wasps to better enhance their beneficial potentials; The development and implementation of methods that measure and monitor agricultural chemicals in the environment; The development of methods that test the toxicological effects of agricultural chemicals on non-target organisms.

**2. Brief description of the target audience**

Target audiences for our work in the Department of Entomology include scientists in various related disciplines, agriculturalists, extension, agribusiness, public policy makers, legislators, government agencies and the general public.

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

**Target for the number of persons (contacts) reached through direct and indirect contact methods**

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
Plan	0	0	0	0
2007	5500	1500	1500	100

**2. Number of Patent Applications Submitted (Standard Research Output)**

**Patent Applications Submitted**

Year	Target
Plan:	0
2007 :	0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

	Extension	Research	Total
Plan			
2007	36	48	84

**V(F). State Defined Outputs**

**Output Target**

**Output #1****Output Measure**

- Peer reviewed journal articles

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2007	30	48

**Output #2****Output Measure**

- Graduate Students supported on Agricultural Research Center and other external funds

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2007	20	24

**V(G). State Defined Outcomes****V. State Defined Outcomes Table of Content**

<b>O No.</b>	<b>OUTCOME NAME</b>
1	Percent of holdings that are implementing changes to IPM based on research findings
2	Percent decrease in pesticide use

**Outcome #1****1. Outcome Measures**

Percent of holdings that are implementing changes to IPM based on research findings

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	50	50

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
216	Integrated Pest Management Systems
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sourc
121	Management of Range Resources
211	Insects, Mites, and Other Arthropods Affecting Plants
215	Biological Control of Pests Affecting Plants

**Outcome #2****1. Outcome Measures**

Percent decrease in pesticide use

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	0	15

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

## Results

### 4. Associated Knowledge Areas

KA Code	Knowledge Area
216	Integrated Pest Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources

### V(H). Planned Program (External Factors)

#### External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Programmatic Challenges
- Other (See Below)

#### Brief Explanation

External factors are primarily economy driven but weather also plays a factor in stakeholder decision making. Growers are trying to incorporate IPM programs into their practices as is being demanded by public policy and user groups. However, the realized price and 'quality' of product needed to reach a maximum realized price are still overriding factors. If growers believe that they can realize a higher price by 'avoiding' a potential problem, they will apply a pesticide even if best IPM practices would indicate that they should not do so.

### V(I). Planned Program (Evaluation Studies and Data Collection)

#### 1. Evaluation Studies Planned

- Retrospective (post program)
- Before-After (before and after program)
- During (during program)
- Time series (multiple points before and after program)

#### Evaluation Results

#### Key Items of Evaluation

**Program #14****V(A). Planned Program (Summary)****1. Name of the Planned Program**

Program in Natural Resource Sciences

**V(B). Program Knowledge Area(s)****1. Program Knowledge Areas and Percentage**

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
112	Watershed Protection and Management			20%	
121	Management of Range Resources			10%	
123	Management and Sustainability of Forest Resources			15%	
135	Aquatic and Terrestrial Wildlife			40%	
136	Conservation of Biological Diversity			15%	
	<b>Total</b>			100%	

**V(C). Planned Program (Inputs)****1. Actual amount of professional FTE/SYs expended this Program**

Year: 2007	Extension		Research	
	1862	1890	1862	1890
<b>Plan</b>	0.0	0.0	12.8	0.0
<b>Actual</b>	0.0	0.0	11.0	0.0

**2. Actual dollars expended in this Program (includes Carryover Funds from previous years)**

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	44455	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	469869	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	929645	0

**V(D). Planned Program (Activity)****1. Brief description of the Activity**

In our research in the Department of Natural Resource Sciences we perform laboratory and field experiments. Data is collected and analyzed. Papers, books, book chapters and reports are written. Presentations are given in local, national and international venues. Graduate students and undergraduate students are mentored and trained. Curriculum is revised and developed.

**2. Brief description of the target audience**

Our target audience includes other researchers within and without the discipline of natural resource sciences including extension educators, persons in industry, economics, policy makers and the general public.

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

**Target for the number of persons (contacts) reached through direct and indirect contact methods**

	<b>Direct Contacts Adults</b>	<b>Indirect Contacts Adults</b>	<b>Direct Contacts Youth</b>	<b>Indirect Contacts Youth</b>
<b>Year</b>	<b>Target</b>	<b>Target</b>	<b>Target</b>	<b>Target</b>
<b>Plan</b>	0	0	0	0
2007	870	725	65	0

**2. Number of Patent Applications Submitted (Standard Research Output)**

**Patent Applications Submitted**

<b>Year</b>	<b>Target</b>
<b>Plan:</b>	0
2007 :	0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

	<b>Extension</b>	<b>Research</b>	<b>Total</b>
<b>Plan</b>			
2007	0	11	11

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Peer Reviewed Publications

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2007	10	11

**Output #2**

**Output Measure**

- Graduate students supported on experiment station and grant funds

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2007	15	12

**V(G). State Defined Outcomes****V. State Defined Outcomes Table of Content**

<b>O No.</b>	<b>OUTCOME NAME</b>
1	graduate students and post-docs trained
2	Percent increase in research support
3	New personnel in research positions

**Outcome #1****1. Outcome Measures**

graduate students and post-docs trained

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	5	5

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

There is a strong demand for MS and PhD level graduates by various employers.

**What has been done**

Continue to aggressively seek research funding to support graduate education.

**Results**

Number of degrees conferred has relatively static due to research funding constraints.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
136	Conservation of Biological Diversity
123	Management and Sustainability of Forest Resources
135	Aquatic and Terrestrial Wildlife
112	Watershed Protection and Management
121	Management of Range Resources

**Outcome #2****1. Outcome Measures**

Percent increase in research support

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	5	5

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Results are important to state and government, landowners and other environmentally concerned stakeholders.

**What has been done**

A variety of research on cougars, pigmy rabbits, mule deer and water quality has been completed.

**Results**

Notable examples have been a changes in cougar hunting laws in the state as have fishing regulations on selected lakes.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
112	Watershed Protection and Management
121	Management of Range Resources
135	Aquatic and Terrestrial Wildlife
136	Conservation of Biological Diversity
123	Management and Sustainability of Forest Resources

**Outcome #3****1. Outcome Measures**

New personnel in research positions

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Quantitative Target</b>	<b>Actual</b>
2007	1	1

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Results are important to state and government, landowners and other environmentally concerned stakeholders.

**What has been done**

Attempted to hire a new faculty member.

**Results**

Search for new faculty member failed.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
121	Management of Range Resources
135	Aquatic and Terrestrial Wildlife
123	Management and Sustainability of Forest Resources
112	Watershed Protection and Management
136	Conservation of Biological Diversity

**V(H). Planned Program (External Factors)****External factors which affected outcomes**

- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations

**Brief Explanation**

**V(l). Planned Program (Evaluation Studies and Data Collection)**

**1. Evaluation Studies Planned**

- Retrospective (post program)
- Other (See Below)

**Evaluation Results**

Annual Benchmarks and Strategic Plans, grant expenditures, refereed publications, number of graduate degrees conferred, professional awards.

**Key Items of Evaluation**

**Program #15****V(A). Planned Program (Summary)****1. Name of the Planned Program**

Wood Materials Engineering Laboratory

**V(B). Program Knowledge Area(s)****1. Program Knowledge Areas and Percentage**

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
511	New and Improved Non-Food Products and Processes			100%	
	<b>Total</b>			100%	

**V(C). Planned Program (Inputs)****1. Actual amount of professional FTE/SYs expended this Program**

Year: 2007	Extension		Research	
	1862	1890	1862	1890
<b>Plan</b>	0.0	0.0	5.7	0.0
<b>Actual</b>	0.0	0.0	2.0	0.0

**2. Actual dollars expended in this Program (includes Carryover Funds from previous years)**

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	11564	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	84481	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	163653	0

**V(D). Planned Program (Activity)****1. Brief description of the Activity**

For the past 12 months, several aspects of processing and application development of biopolyesters (PLA and PHAs) were investigated. We studied effects of processing methods on mechanical and physical properties of wood/PHA composites, including injection molding and extrusion. Reinforcing and toughening mechanisms of PLA using rigid inorganic filler were further elucidated. Effect of bamboo fiber-induced crystallization of PHBV on mechanical properties and effects of the added nucleating agent on the fiber induced crystallization and mechanical properties of the composites were investigated. Reinforcing PHBV with cellulose nanowhisker was also investigated. The research results from this project were presented at professional conferences. Three invited oral presentations were given at: 1. ACS symposium on polymers from Renewable Resources, 234th ACS National Meeting, Boston, Aug, 19-23, 2007; 2. 9th International Conference on Wood Biofiber Plastic Composites, Madison, WI, May 21-23, 2007; 3. The symposium on Biomedical/Biorelated Materials at the AAAS Pacific Division conference; ACS Northwest regional meeting, Boise, ID, June 1-21, 2007. A general oral presentation at the International Symposium on Polymers and the Environment: Emerging Technology and Science, the 2007 BioEnvironmental Polymer Society Annual Meeting, Vancouver, WA, October 17-20, 2007. An invited seminar was given at the USDA Eastern Regional Research Center, Wyndmoor, PA, May 25, 2007.

**2. Brief description of the target audience**

The target audience for this program will be the forest products industry, composite industry, and packaging materials industry.

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

**Target for the number of persons (contacts) reached through direct and indirect contact methods**

	<b>Direct Contacts Adults</b>	<b>Indirect Contacts Adults</b>	<b>Direct Contacts Youth</b>	<b>Indirect Contacts Youth</b>
<b>Year</b>	<b>Target</b>	<b>Target</b>	<b>Target</b>	<b>Target</b>
<b>Plan</b>	0	0	0	0
2007	100	500	0	0

**2. Number of Patent Applications Submitted (Standard Research Output)**

**Patent Applications Submitted**

<b>Year</b>	<b>Target</b>
<b>Plan:</b>	0
2007 :	0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

	<b>Extension</b>	<b>Research</b>	<b>Total</b>
<b>Plan</b>			
2007	0	3	3

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Peer Reviewed journal Articles

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2007	3	3

**V(G). State Defined Outcomes****V. State Defined Outcomes Table of Content**

<b>O No.</b>	<b>OUTCOME NAME</b>
1	Methods to improve the compatibility of natural fiber and biopolyesters and melt strength of biocomposites, knowledge of composition-morphology-property relationships of composites
2	Microcellular foaming extrusion process design and processing optimization of biocomposites; characterization of composition-morphology-property relationships of microcellular foam
3	Product application development of microcellular foaming technology of biocomposites

**Outcome #1**

**1. Outcome Measures**

Methods to improve the compatibility of natural fiber and biopolyesters and melt strength of biocomposites, knowledge of composition-morphology-property relationships of composites

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	1	1

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Fiber induced crystallization of polymer has been studied by many others. However, its role in mechanical properties of the composites is still not clear.

**What has been done**

For the first time, we demonstrated that by adding a nucleating agent to the bamboo/PHBV composite, the overall properties of the neat polymer and the composites were improved due to refined crystalline structures. The added nucleating agent basically minimized the fiber induced crystallization. Part of the results on bamboo fiber reinforced PHBV has been submitted for publication. We first elucidated the toughening mechanisms PLA nanocomposites with organo- clay and nano-sized CaCO<sub>3</sub>. While CaCO<sub>3</sub> causes massive crazing which toughens the PLA, organo-clay at low concentration allows large shear yielding. This finding should be considered very important, because it will provide significant information in future design of PLA nanocomposites. Part of the results from this research has been published in a recent issue of Polymer journal.

**Results**

Part of the results from this research has been published in a recent issue of Polymer journal.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
511	New and Improved Non-Food Products and Processes

**Outcome #2**

**1. Outcome Measures**

Microcellular foaming extrusion process design and processing optimization of biocomposites; characterization of composition-morphology-property relationships of microcellular foam

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	1	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Fiber induced crystallization of polymer has been studied by many others. However, its role in mechanical properties of the composites is still not clear.

**What has been done**

There was not a measurable outcome for this program in 2007. The project is progressing.

**Results**

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
511	New and Improved Non-Food Products and Processes

**Outcome #3**

**1. Outcome Measures**

Product application development of microcellular foaming technology of biocomposites

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	0	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Fiber induced crystallization of polymer has been studied by many others. However, its role in mechanical properties of the composites is still not clear.

**What has been done**

There was not a measurable outcome for this program in 2007. The project is progressing.

**Results**

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
511	New and Improved Non-Food Products and Processes

**V(H). Planned Program (External Factors)**

**External factors which affected outcomes**

- Public Policy changes
- Government Regulations

**Brief Explanation**

Cellulose and starch are the two most abundant plant polymers extensively available in the United States. Utilization of these polymers or their derivatives for materials results in direct energy saving and environmental benefit. Favorable governmental regulations such as the federal procurement of biobased products boost the research and development interest from both academic institutions and industry. This project addresses the research need in the national biomass technologies roadmap for the development of alternatives to petroleum-based chemicals, polymers, plastics, and synthetic fibers. According to this roadmap, production of chemicals and materials from biomass will need to increase from 5% of the production of target US chemical commodities in 2001, to 18% in 2020, and to 25% in 2030. The proposed research is directly responsive to one National Research Initiative priority in Biobased Products and Bioenergy Production Research, which calls for innovative non-food uses of biomass for the sustainable production of industrial products. This project is also aligned with the current NRI and USDA strategic planning in enhancing economic opportunities for agricultural producers and protecting the nation,s environment.

#### **V(I). Planned Program (Evaluation Studies and Data Collection)**

##### **1. Evaluation Studies Planned**

- Before-After (before and after program)
- During (during program)

#### **Evaluation Results**

#### **Key Items of Evaluation**

**Program #16**

**V(A). Planned Program (Summary)**

**1. Name of the Planned Program**

Program in Biological Systems Engineering

**V(B). Program Knowledge Area(s)**

**1. Program Knowledge Areas and Percentage**

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships			10%	
111	Conservation and Efficient Use of Water			5%	
112	Watershed Protection and Management			5%	
133	Pollution Prevention and Mitigation			5%	
205	Plant Management Systems			5%	
402	Engineering Systems and Equipment			10%	
403	Waste Disposal, Recycling, and Reuse			5%	
501	New and Improved Food Processing Technologies			35%	
502	New and Improved Food Products			5%	
511	New and Improved Non-Food Products and Processes			15%	
<b>Total</b>				100%	

**V(C). Planned Program (Inputs)**

**1. Actual amount of professional FTE/SYs expended this Program**

Year: 2007	Extension		Research	
	1862	1890	1862	1890
<b>Plan</b>	0.0	0.0	34.8	0.0
<b>Actual</b>	0.0	0.0	35.0	0.0

**2. Actual dollars expended in this Program (includes Carryover Funds from previous years)**

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	354094	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	929996	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	2524227	0

**V(D). Planned Program (Activity)**

**1. Brief description of the Activity**

We plan to support a vigorous graduate research program crucial to the development of high quality research in our focal areas of interest. We will develop and evaluate innovative water/soil management practices that mitigate the effects of uncertain water resources (both precipitation and irrigation) and other factors associated with climate change and atmospheric CO2 elevation. We will develop a roadmap for bioproducts and bioenergy technology that is specific to the region, s energy needs and to the crops/biomass grown in the region. We will develop food processing technologies that provide nutritious new products, increase the safety of existing products, and help improve the overall health of the population.

**2. Brief description of the target audience**

The target audience is the scientific community in biological systems engineering, general agriculture, agribusiness, extension personnel, growers in the region, state and national agencies, and non-governmental agencies.

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

**Target for the number of persons (contacts) reached through direct and indirect contact methods**

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
Plan	0	0	0	0
2007	0	0	0	0

**2. Number of Patent Applications Submitted (Standard Research Output)**

**Patent Applications Submitted**

Year	Target
Plan:	0
2007 :	1

**Patents listed**

Struvite production from animal wastewater through releasing phosphorus.

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

	Extension	Research	Total
Plan			
2007	0	45	45

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Peer Reviewed Journal Articles

Year	Target	Actual
2007	40	45

**Output #2**

**Output Measure**

- Graduate Students supported on Agricultural Research Center and grant funds

Year	Target	Actual
2007	20	18

**V(G). State Defined Outcomes****V. State Defined Outcomes Table of Content**

<b>O No.</b>	<b>OUTCOME NAME</b>
1	Initiate laboratory bench research on processing 2 agricultural feedstocks to produce new products, new energy sources, etc.
2	Initiate pilot scale research on processing of two agricultural feedstocks to produce new products or energy sources
3	Processing technology of one agricultural commodity to produce new products or energy sources available for transfer
4	Process Technology Development at the laboratory bench for first three years; 4th year to the pilot scale; 5th year to the industry
5	Development of computer models or modules to existing models and Best Management Practices (BMPs)
6	Hire one faculty member or expand research in biofuels and bioproducts engineering

**Outcome #1****1. Outcome Measures**

Initiate laboratory bench research on processing 2 agricultural feedstocks to produce new products, new energy sources, etc.

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	2	1

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Adding agricultural feedstocks to produce new products and energy sources will be of significant benefit to growers in developing new uses for products and to consumers in developing new ways to produce energy sources.

**What has been done**

Work has begun on using microorganisms to digest wheat straw into ethanol.

**Results**

The work is in its preliminary stages and has produced promising results using both fungi and bacteria to digest straw.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
402	Engineering Systems and Equipment
403	Waste Disposal, Recycling, and Reuse
511	New and Improved Non-Food Products and Processes

**Outcome #2****1. Outcome Measures**

Initiate pilot scale research on processing of two agricultural feedstocks to produce new products or energy sources

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	0	1

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Adding agricultural feedstocks to produce new products and energy sources will be of significant benefit to growers in developing new uses for products and to consumers in developing new ways to produce energy sources.

**What has been done**

Research has focused on improving anaerobic digestion technology. A pilot digester was used to evaluate anaerobic digestion in winter conditions. Studies on recovering nutrients and in producing fiber for use by the nursery industry were continuing.

### Results

The fiber produced was suitable for use in the nursery industry, although it was necessary to supplement it with nutrients. Nutrient recovery for ammonia and phosphorus was improved. A mathematical model for anaerobic digestion was improved during the course of research. Understanding of nutrient recovery during anaerobic digestion was significantly expanded during the year's research.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
402	Engineering Systems and Equipment
511	New and Improved Non-Food Products and Processes

### Outcome #3

#### 1. Outcome Measures

Processing technology of one agricultural commodity to produce new products or energy sources available for transfer

#### 2. Associated Institution Types

•1862 Research

#### 3a. Outcome Type:

Change in Condition Outcome Measure

#### 3b. Quantitative Outcome

Year	Quantitative Target	Actual
2007	0	0

#### 3c. Qualitative Outcome or Impact Statement

##### Issue (Who cares and Why)

Adding agricultural feedstocks to produce new products and energy sources will be of significant benefit to growers in developing new uses for products and to consumers in developing new ways to produce energy sources.

##### What has been done

Research is continuing at the laboratory bench scale and at the pilot scale but is not ready for transfer.

##### Results

A cooperating dairy farmer has an anaerobic digester on his farm and WSU has a pilot-scale digester at its dairy facility. This testing of equipment is hastening the research to the point of transferring technology for use in agricultural operations.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
511	New and Improved Non-Food Products and Processes
402	Engineering Systems and Equipment

### Outcome #4

#### 1. Outcome Measures

Process Technology Development at the laboratory bench for first three years; 4th year to the pilot scale; 5th year to the industry

#### 2. Associated Institution Types

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	1	2

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

The development of technologies in food engineering will improve food processing, making processed food safer, healthier, and more flavorful. These developments are especially important in maintaining the competitiveness of the food industry in the United States in the midst of international competition.

**What has been done**

The use of microwave heating in food processing is proceeding toward making a request for Food and Drug Administration approval of this technology. The use of pulsed electric fields (PEF) and high hydrostatic pressure (HHP) are under study with regard to milk, flavored milk, yogurt, and other dairy products.

**Results**

Installation of microwave heating equipment is nearly complete and the project is on schedule for submitting data to the FDA for approval of the use of the technology. Both PEF and HHP showed substantial promise in the processing of dairy products.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
502	New and Improved Food Products

**Outcome #5****1. Outcome Measures**

Development of computer models or modules to existing models and Best Management Practices (BMPs)

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	1	1

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

The development of computer models is of substantial benefit to people making decisions in a variety of ways regarding agriculture. Producers can make better decisions about potential for developing crops or for changing practices. Models provide better information to people making decisions about the use of land and about conserving resources such as soil, water, and nutrients.

**What has been done**

The two major computer models under study are CropSyst, a comprehensive cropping systems simulation model, and the Water Erosion Prediction Project (WEPP). The project on CropSyst developed a linked soil carbon-nitrogen cycling module. It is also now available in an Excel-based version written in Visual Basic for Applications and linked to Microsoft Access. Another project has begun experiments to evaluate and modify WEPP for simulation of snow redistribution and soil water.

**Results**

CropSyst is now more thorough in its evaluation of carbon and nitrogen during agricultural operations. It is also more useful as a farming systems tool because it combines database management and cropping systems simulation. The continuing development of WEPP is improving understanding of management impacts on snow transport and enabling cost-efficient assessment of alternative cropping systems and residue management scenarios.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
511	New and Improved Non-Food Products and Processes
112	Watershed Protection and Management
102	Soil, Plant, Water, Nutrient Relationships
205	Plant Management Systems
111	Conservation and Efficient Use of Water

**Outcome #6****1. Outcome Measures**

Hire one faculty member or expand research in biofuels and bioproducts engineering

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Quantitative Target</b>	<b>Actual</b>
2007	0	1

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

The department needs another faculty member in this area in order to provide sufficient expertise to move forward in this general area of research.

**What has been done**

The department conducted a thorough search and found suitable candidates. The department and the college made an offer to a candidate and he accepted.

**Results**

A new, very promising faculty member was hired.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
403	Waste Disposal, Recycling, and Reuse
402	Engineering Systems and Equipment

**V(H). Planned Program (External Factors)****External factors which affected outcomes**

- Economy
- Appropriations changes
- Public Policy changes
- Competing Public priorities
- Competing Programmatic Challenges

**Brief Explanation**

**V(I). Planned Program (Evaluation Studies and Data Collection)**

**1. Evaluation Studies Planned**

- After Only (post program)
- Comparisons between different groups of individuals or program participants experiencing different levels of program intensity.

**Evaluation Results**

**Key Items of Evaluation**

**Program #17**

**V(A). Planned Program (Summary)**

**1. Name of the Planned Program**

Institute of Biological Chemistry

**V(B). Program Knowledge Area(s)**

**1. Program Knowledge Areas and Percentage**

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
201	Plant Genome, Genetics, and Genetic Mechanisms			18%	
202	Plant Genetic Resources			2%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants			19%	
204	Plant Product Quality and Utility (Preharvest)			3%	
205	Plant Management Systems			4%	
206	Basic Plant Biology			34%	
211	Insects, Mites, and Other Arthropods Affecting Plants			8%	
511	New and Improved Non-Food Products and Processes			6%	
701	Nutrient Composition of Food			6%	
<b>Total</b>				<b>100%</b>	

**V(C). Planned Program (Inputs)**

**1. Actual amount of professional FTE/SYs expended this Program**

Year: 2007	Extension		Research	
	1862	1890	1862	1890
<b>Plan</b>	0.0	0.0	68.9	0.0
<b>Actual</b>	0.0	0.0	67.0	0.0

**2. Actual dollars expended in this Program (includes Carryover Funds from previous years)**

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	124978	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	1964537	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	4998777	0

**V(D). Planned Program (Activity)**

**1. Brief description of the Activity**

The Institute of Biological Chemistry faculty have a vigorous graduate research and training program. This leads to the graduation and placement of its highly trained (Ph.D./M.S.) scientists, to publications in high quality journals, to developing patents and working with industry to implement the technologies developed, as well as carrying out needed outreach activities (e.g. to focus groups, high school students, general public, etc.).

**2. Brief description of the target audience**

The primary target audience of the Institute of Biological Chemistry is scientists within various disciplines in plant biotechnology, particularly plant biochemistry. Their research activities attract attention within the biochemical, forest products, and agricultural industries.

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

**Target for the number of persons (contacts) reached through direct and indirect contact methods**

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
Plan	0	0	0	0
2007	0	0	0	0

**2. Number of Patent Applications Submitted (Standard Research Output)**

**Patent Applications Submitted**

Year	Target
Plan:	2
2007 :	0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

	Extension	Research	Total
Plan			
2007	0	39	39

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Peer reviewed journal articles

Year	Target	Actual
2007	50	39

**Output #2**

**Output Measure**

- Supporting graduate students on Agricultural Research Center and External Funding

Year	Target	Actual
2007	32	27

**V(G). State Defined Outcomes****V. State Defined Outcomes Table of Content**

<b>O No.</b>	<b>OUTCOME NAME</b>
1	Increase numbers of students
2	Patents
3	External Funding in millions of dollars
4	Peer reviewed journal articles

**Outcome #1****1. Outcome Measures**

Increase numbers of students

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	32	27

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Graduate education of top tier students in plant biochemistry, genetics, cell biology and related fields is needed to produce future scientists who will do basic research in areas of new food sources, improved food products, new fuel sources, plant protection and crop improvement.

**What has been done**

Institute faculty previously recruited most of their graduate students from a unit now called the School of Molecular Biosciences. That unit has reduced their enrollment of students interested in plant biochemistry and plant genetics/cell biology. At present many of the faculty recruit students primarily through the Graduate Program in Molecular Plant Sciences. Many of the applicants to the program do not have the biochemical background or interest to succeed as researchers at the Institute and tend to enter other more biologically based laboratories elsewhere in the university. It should be mentioned that direct recruitment into IBC laboratory programs does occur. Additionally, the Institute takes part in an Integrated Plant Sciences Retreat and recruitment weekend each February and also houses and helps support the Molecular Plant Sciences Graduate Program.

**Results**

Recruitment of some top tier students is occurring but not to the extent that Institute faculty would prefer and could finance. Efforts to collaborate with other units such as Chemistry are in progress, to help bring in top students with strong biochemistry backgrounds. The result is that at present, the unit is not reaching its enrollment goal.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
202	Plant Genetic Resources
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
206	Basic Plant Biology
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
701	Nutrient Composition of Food

**Outcome #2****1. Outcome Measures**

Patents

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	2	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Patent applications and awards are indications that IBC researchers are making new and novel discoveries in plants that might have commercial applications.

**What has been done**

We continue to look for commercial applications.

**Results**

Patents were awarded in 2006. No patents were awarded in 2007. To date, one patent has been awarded for 2008.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
511	New and Improved Non-Food Products and Processes
201	Plant Genome, Genetics, and Genetic Mechanisms
211	Insects, Mites, and Other Arthropods Affecting Plants
206	Basic Plant Biology

**Outcome #3****1. Outcome Measures**

External Funding in millions of dollars

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	0	4951958

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Extramural funding from federal and non federal agencies comprises the Institute's main financial resource and is used to pay for supplies, equipment, and salaries for graduate research assistants and postdoctoral researchers. Approximately 60% of the unit's expenditures are extramural (grant and development funds). Without extramural funding, the Institute faculty would be unable to complete their research goals.

**What has been done**

IBC faculty continue to submit grant proposals.

**Results**

Extramural income in fiscal year 2007 (\$4,951,958) has increased by \$1.45 million since fiscal year 2006 (\$3,498,351).

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
204	Plant Product Quality and Utility (Preharvest)
202	Plant Genetic Resources
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
701	Nutrient Composition of Food
201	Plant Genome, Genetics, and Genetic Mechanisms
206	Basic Plant Biology
511	New and Improved Non-Food Products and Processes

**Outcome #4****1. Outcome Measures**

Peer reviewed journal articles

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Quantitative Target</b>	<b>Actual</b>
2007	50	39

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Journal articles are of value because they explain research results to the scientific community and should be, if written properly (and after review and revision), have research results that may be soundly discussed, reasoned out and replicated. Review also helps limit the possibility of plagiarism and other unethical activities. Journal articles that are read by the scientific community can also spur new research and collaborations in areas heretofore unthought-of by the original researcher. The end result is that journal articles document research.

**What has been done**

As research is completed and understanding is gained, faculty work with graduate students, research technologists and postdoctoral fellows to write papers for publication.

**Results**

The average number of peer reviewed journal publications per faculty in 2007 is 4.3 (9 faculty). For 2006 the amount was 5.44 and for 2005, 5.22.

The reduction in publications may be partially due to the death of one of the faculty members in 2007 (Clarence A. Ryan). The Institute had also expected to hire one-to-two new faculty members in 2007, but the hires have been delayed until late 2008. This is expected to affect 2008 figures as well.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
205	Plant Management Systems
701	Nutrient Composition of Food
511	New and Improved Non-Food Products and Processes
206	Basic Plant Biology
204	Plant Product Quality and Utility (Preharvest)
211	Insects, Mites, and Other Arthropods Affecting Plants
201	Plant Genome, Genetics, and Genetic Mechanisms
202	Plant Genetic Resources
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants

## **V(H). Planned Program (External Factors)**

### **External factors which affected outcomes**

- Economy
- Appropriations changes
- Public Policy changes
- Competing Public priorities
- Competing Programmatic Challenges
- Other (See Below)

### **Brief Explanation**

The reduction in publications may be partially due to the death of one of the faculty members in 2007 (Clarence A. Ryan). The Institute had also expected to hire one-to-two new faculty members in 2007, but the hires have been delayed until late 2008. This is expected to affect 2008 figures as well.

## **V(I). Planned Program (Evaluation Studies and Data Collection)**

### **1. Evaluation Studies Planned**

- Before-After (before and after program)
- During (during program)

### **Evaluation Results**

### **Key Items of Evaluation**

**Program #18****V(A). Planned Program (Summary)****1. Name of the Planned Program**

Program in Crop Genetics and Breeding

**V(B). Program Knowledge Area(s)****1. Program Knowledge Areas and Percentage**

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
201	Plant Genome, Genetics, and Genetic Mechanisms			66%	
202	Plant Genetic Resources			10%	
204	Plant Product Quality and Utility (Preharvest)			24%	
	<b>Total</b>			100%	

**V(C). Planned Program (Inputs)****1. Actual amount of professional FTE/SYs expended this Program**

Year: 2007	Extension		Research	
	1862	1890	1862	1890
<b>Plan</b>	0.0	0.0	55.4	0.0
<b>Actual</b>	0.0	0.0	34.0	0.0

**2. Actual dollars expended in this Program (includes Carryover Funds from previous years)**

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	398470	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	848743	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	2295094	0

**V(D). Planned Program (Activity)****1. Brief description of the Activity**

Develop, test, obtain plant variety patents and release new commercial cultivars of wheat and barley. Publish journal papers on the development of new breeding techniques that improve efficiency by using genetic markers. Establish patents on biologically unique organisms and processes. Publish journal papers on wheat and barley genomes, genome structure and function. Develop and adapt cultivars for specific management systems, such as direct seed, organic, perennial or animal-based systems. Publish papers and advance technology transfer of novel end use purposes for food, bioproduct and bioenergy applications for commercial adaptation.

**2. Brief description of the target audience**

The target audience includes other crop scientists, economists, commodity commissions, policy makers, legislators, agribusiness, food processors, and farmers.

**V(E). Planned Program (Outputs)****1. Standard output measures**

Target for the number of persons (contacts) reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
Plan	0	0	0	0
2007	5365	60300	200	1000

**2. Number of Patent Applications Submitted (Standard Research Output)****Patent Applications Submitted**

Year	Target
Plan:	1
2007 :	3

**Patents listed**

Non-GMO glyphosate tolerant wheat genotypes - Patent  
MDM wheat - PVP  
Bauermeister Wheat - PVP

**3. Publications (Standard General Output Measure)****Number of Peer Reviewed Publications**

	Extension	Research	Total
Plan			
2007	1	17	18

**V(F). State Defined Outputs****Output Target****Output #1****Output Measure**

- Peer reviewed journal publications

Year	Target	Actual
2007	30	18

**Output #2****Output Measure**

- Graduate students supported on Agricultural Research Center or other external funds

Year	Target	Actual
2007	20	21

**Output #3****Output Measure**

- Plant Patents and plant variety protections (PVPs)

Year	Target	Actual
2007	2	3

**V(G). State Defined Outcomes****V. State Defined Outcomes Table of Content**

<b>O No.</b>	<b>OUTCOME NAME</b>
1	Publications on improved knowledge of wheat, barley genetics, genome, new breeding tools impacting the national, international breeding, and genetic scientific community
2	Commercial cultivar releases that are adapted regionally

**Outcome #1****1. Outcome Measures**

Publications on improved knowledge of wheat, barley genetics, genome, new breeding tools impacting the national, international breeding, and genetic scientific community

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	30	18

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Publications on these aspects of genetics and breeding affects the international community of cereal geneticists and breeders. Expanded knowledge in these areas allows progress in understanding genes, genetic mechanisms, and breeding processes in particularly barley and wheat.

**What has been done**

Reports have been made on herbicide resistance in weeds and crops, inheritance of seed dormancy and Pre-harvest sprouting in barley, wheat end use quality, genetics of wheat and barley rust resistance, cytogenetics of wheat relatives useful for wheat breeding, wheat variety response to organic production methods, and breeding methodologies for low input systems.

**Results**

New information has been gained to better understand the genes involved and inheritance patterns of wheat and barley rust resistance genes, wheat end use quality genes (polyphenol oxidase), and dormancy and pre-harvest sprouting genes in barley. In the latter case the genes have been mapped and molecular markers identifies, which will aid in breeding of improved balance between dormancy and Pre-harvest sprouting in barley and potentially wheat. New knowledge also will aid small grain breeding for organic production systems, low input production systems, and perennial wheat varieties.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
204	Plant Product Quality and Utility (Preharvest)
201	Plant Genome, Genetics, and Genetic Mechanisms
202	Plant Genetic Resources

**Outcome #2****1. Outcome Measures**

Commercial cultivar releases that are adapted regionally

**2. Associated Institution Types**

•1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	2	3

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

New grain cultivars carry improvements over existing cultivars, which benefit farms, processors, exporters, and/or end users. Variety development is followed closely especially by farmers and processors.

**What has been done**

Three new cultivars were released in 2007.

**Results**

The new cultivars will give more options for farmers to plant in their rotations. They will also provide new export opportunities. In 2007, in Washington State, about 55% of the 2,270,000 acres sown to wheat were WSU cultivars, while about 15% of the 230,000 acres sown to barley were WSU cultivars. The proportional earnings from WSU wheat and barley cultivars harvested were \$538 and \$10 million, respectively. The WSU cereal variety testing program provided information to growers, which enabled them to select improved cultivars vs average cultivars. It was estimated this information is worth about \$25 million/yr to farmers in increased yield and quality returns.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
202	Plant Genetic Resources
204	Plant Product Quality and Utility (Preharvest)

**V(H). Planned Program (External Factors)****External factors which affected outcomes**

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges

**Brief Explanation**

Major factors in 2007 include continuing drought, which impacted field results and the total loss of several test sites; Iraq war negative impacts on the economy including inflation; and especially the total direct loss of special grants when all earmarks were stricken from the federal budget.

**V(I). Planned Program (Evaluation Studies and Data Collection)****1. Evaluation Studies Planned**

- Before-After (before and after program)
- During (during program)

**Evaluation Results**

An internal/external review of the wheat breeding programs was conducted, which resulted in recommendations for improvement including better communication and innovation among the scientists.

**Key Items of Evaluation**

**Program #19**

**V(A). Planned Program (Summary)**

**1. Name of the Planned Program**

Program in Sustainable Crop and Soil Management

**V(B). Program Knowledge Area(s)**

**1. Program Knowledge Areas and Percentage**

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships			100%	
	<b>Total</b>			100%	

**V(C). Planned Program (Inputs)**

**1. Actual amount of professional FTE/SYs expended this Program**

Year: 2007	Extension		Research	
	1862	1890	1862	1890
<b>Plan</b>	0.0	0.0	44.8	0.0
<b>Actual</b>	0.0	0.0	72.0	0.0

**2. Actual dollars expended in this Program (includes Carryover Funds from previous years)**

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	1081609	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	2031798	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	5034148	0

**V(D). Planned Program (Activity)**

**1. Brief description of the Activity**

Develop bioproducts from crop residues. Demonstrate high quality and safe food from organic and sustainable production systems. Document environmental services provided by sustainable cropping systems. Improve efficiency and safety of waste recycling systems in agricultural production. Identify soil biological organisms important in crop production, residue decomposition and soil building. . Develop soil management programs for new crop species and cultivars of evolving cropping systems in collaboration with crop genetic and breeding teams. Publish journal papers on unique findings related to the above topics. Establish patents on biologically unique organisms and processes. Disseminate information on the above systems to facilitate adoption and commercialization.

**2. Brief description of the target audience**

The target audience includes other soil scientists, economists, commodity commissions, policy makers, legislators, agribusiness, and farmers.

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

**Target for the number of persons (contacts) reached through direct and indirect contact methods**

	<b>Direct Contacts Adults</b>	<b>Indirect Contacts Adults</b>	<b>Direct Contacts Youth</b>	<b>Indirect Contacts Youth</b>
<b>Year</b>	<b>Target</b>	<b>Target</b>	<b>Target</b>	<b>Target</b>
<b>Plan</b>	0	0	0	0
2007	10900	1500	350	500

**2. Number of Patent Applications Submitted (Standard Research Output)**

**Patent Applications Submitted**

<b>Year</b>	<b>Target</b>
<b>Plan:</b>	0
2007 :	0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

	<b>Extension</b>	<b>Research</b>	<b>Total</b>
<b>Plan</b>			
2007	14	19	33

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Peer reviewed journal publications

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2007	46	33

**Output #2**

**Output Measure**

- Graduate students supported by Agricultural Research Center and other external funds

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2007	20	30

**V(G). State Defined Outcomes****V. State Defined Outcomes Table of Content**

<b>O No.</b>	<b>OUTCOME NAME</b>
1	Publications dealing with improved knowledge of crop rotations, nutrient cycling, soil building and carbon sequestration, fertility management, soil structure and soil water movement, chemical movement in soils, tools for spatial monitoring and management.

**Outcome #1****1. Outcome Measures**

Publications dealing with improved knowledge of crop rotations, nutrient cycling, soil building and carbon sequestration, fertility management, soil structure and soil water movement, chemical movement in soils, tools for spatial monitoring and management.

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2007	25	19

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Publications on these aspects of sustainable crop and soil management affects the international community of agronomists and soil scientists. Expanded knowledge in these areas allows progress in understanding basic aspects of crop production. This in turn allows progress in developing best management practices, which directly benefits farmers and their success, and indirectly the greater public, as the environment improves.

**What has been done**

Reports have been made on weed control in crops; fertilization of crops; fertilization effects on grain and residue composition, decomposition, and processing; organic crop production methods; crop rotation and direct seeding / reduced tillage methods and their effects, on production and economics; and improved methods of measuring soil physical, chemical, and microbial parameters.

**Results**

Better understanding has been gained of the ecology and control of weeds in Washington crops and environments. It was estimated that the adoption of one new herbicide alone would save farmers ~\$2 million across the state, and reduce the chemical load in the environment by ~120,000#. The cost of soil erosion in the Palouse alone has been >\$70 million/yr due to lowered crop yields, lost nutrients, and cleanup. Adoption of reduced tillage methods has reduced erosion by 25-50% with a cost savings of up to \$35 million/yr. This has improved water and air quality for all as well. Improved fertilizer application methods in cereals, forages, potato, grape, onion, and turfgrass production has reduced production costs and nutrient runoff and leaching with a cost savings of >\$6 million/yr in dryland areas alone. Organic agriculture production has risen dramatically in Washington partly due to increased demand and partly due to WSU's emphasis on education and production methods research.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships

**V(H). Planned Program (External Factors)****External factors which affected outcomes**

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges

### **Brief Explanation**

Major factors in 2007 include continuing drought, which impacted field research results; Iraq war negative impacts on the economy including inflation, which affects production input costs, which in turn puts downward pressure on farmer adoption of new technologies, especially soil conservation measures; and especially the total direct loss of special grants when all earmarks were stricken from the federal budget. Increased costs of inputs affecting farmers also affect researchers.

### **V(l). Planned Program (Evaluation Studies and Data Collection)**

#### **1. Evaluation Studies Planned**

- Before-After (before and after program)
- During (during program)

### **Evaluation Results**

### **Key Items of Evaluation**